I. C. 7498 APRIL 1949

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
JAMES BOYD, DIRECTOR

RECEIVED
MAY 12 1949
O. S. U. LIBRARY

INFORMATION CIRCULAR

FIRE-FIGHTING FACILITIES AT FOUR PENNSYLVANIA BITUMINOUS-COAL MINES

BY

G. W. GROVE AND O. V. SIMPSON

I. C. 7498,
April 1949.

INFORMATION CIRCULAR

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

FIRE-FIGHTING FACILITIES AT FOUR PENNSYLVANIA BITUMINOUS-COAL MINES[1]

By G. W. Grove[2] and O. V. Simpson[3]

CONTENTS

	Page
Introduction	3
Acknowledgments	3
Hazards of mine fires	3
Serious results of mine fires	4
Fire-fighting facilities	5
Indianola mine, Republic Steel Corp	6
Springdale mine, Allegheny Pittsburgh Coal Co	9
Renton No. 3 mine, Pittsburgh Coal Co	11
Montour No. 10 mine, Pittsburgh Coal Co	14
Requirements of mining laws and Federal safety code for fire-fighting facilities	16
Conclusions	16

ILLUSTRATIONS

Fig.		Follows page
1.	Diagram of water system. Republic Steel Corp. Indianola mine	6
2.	Water stream through adjustable nozzle. Water and pressure supplied by Indianola's municipal water system	6
3.	Pipe connections on main discharge line near the man-supply shaft bottom. Water and pressure are supplied from this point for the fire-fighting water lines underground	6
4.	Main pumping station near man-supply shaft bottom. Room is of fireproof construction, wiring in conduit, and equipped with a CO_2-type fire extinguisher	6

---

[1] The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7498."

[2] Supervising engineer, District A, Health and Safety Division, Bureau of Mines, Pittsburgh, Pa.

[3] Coal-mine inspector, Coal-Mine Inspection Branch, Bureau of Mines, Pittsburgh, Pa.

ILLUSTRATIONS (Contd.)

Fig. — Follows page
5. Fire station along a panel-main entry underground. Note fireplug and water line 6
6. Fireplug along panel-main haulage road with fire hose and nozzle attached. Note fog from the adjustable nozzle 6
7. Another view of a fireplug, hose, and nozzle under pressure. Distance from nozzle to end of water stream approximately 75 feet 6
8. Fire-fighting car equipped with a 40-horsepower direct-current motor, large centrifugal pump, fire hose, nozzles, and tools. Connections are provided for connecting to water-line outlets underground if additional pressure is needed 8
9. Chemical fire-fighting car. The car is equipped with two 75-gallon-capacity tanks, 75 feet of 1-inch fire hose, and a nozzle 8
10. End view of chemical car in operation 8
11. Mining machine equipped with two bags of rock dust and a CO$_2$-type fire extinguisher. Water from the tank car is used to allay dust 8
12. Side view of a mining machine 8
13. Officials' "jeep." This car is equipped with a large, hand-operated, CO$_2$-type fire extinguisher, 12 self-rescuers, and a first-aid kit 8
14. Underground generator room equipped with fire-emergency doors 8
15. Diagram of water system, Allegheny Pittsburgh Coal Co. Springdale mine 10
16. Fire-hose house on surface containing fire hose and chemical tanks on trucks 10
17. Hose on reel and nozzle kept near underground motor barn 10
18. View of track-mounted chemical fire truck 10
19. Typical fireplug, hose, reel, and nozzle installed along water lines 10
20. Adjustable nozzle being used for constant stream 10
21. Fog nozzle in action 10
22. Quart fire extinguisher carried on locomotive 10
23. 2-1/2-gallon fire extinguishers maintained at each first-aid station 10
24. Quart fire extinguisher and bag of rock dust maintained at small pump room 10
25. Diagram of water system. Pittsburgh Coal Co. Renton No. 3 mine 12
26. Two tanks with a combined capacity of 166,000 gallons of water for tipple, cleaning plant, and fire-fighting purposes underground 12
27. Two 6-inch lines leading from tank, one of which enters the mine through the man-supply shaft 12
28. Part of fire car that contains switches, motor, centrifugal pump, reel, and 500 feet of 1-inch hose 12
29. End view of the 1,450-gallon-capacity fire car that is kept in the mine 12

ILLUSTRATIONS (Contd.)

Fig.		Follows page
30.	Mining machine with 20-pound CO_2-type fire extinguisher and holder..	12
31.	Diagram of water system. Pittsburgh Coal Co. Montour No. 10 mine..	14
32.	A view of both fire cars..	14
33.	Side view of fire car with fire hose coiled on top of it.....	14
34.	One of the fire cars in action..	16

INTRODUCTION

During the years 1945, 1946, 1947, and up to July 1, 1948, only one death was caused by mine fires in bituminous-coal mines of the United States. The one fatality occurred in an Illinois mine in December 1945, and, therefore, there had been a period of 2-1/2 years in which no deaths occurred as the result of mine fires. Moreover, 1946 was the first year since 1930 in which no deaths occurred from mine fires. This record is markedly better than that of 1944, when 89 fatalities and great property damage were caused by mine fires in bituminous-coal mines and 16 additional men were killed by an explosion that occurred while they were attempting to seal a mine fire.

ACKNOWLEDGMENTS

Acknowledgment is gratefully made to H. C. Rose, vice president, Robert Penman, superintendent, Renton No. 3 mine, and Harold Laing, superintendent, Montour No. 10 mine, Pittsburgh Coal Co.; to J. L. Hamilton, manager, Northern Coal Mines, and G. D. Wyant, superintendent, Indianola mine, Republic Steel Corp.; and to J. M. Connor, general superintendent, and Arthur Hall, superintendent, Springdale mine, Allegheny Pittsburgh Coal Co., for furnishing and reviewing material pertaining to their mines; and to Carl H. Seeling, mining engineer, and P. P. Senio, motion-picture specialist, Bureau of Mines, for taking the photographs reproduced in this publication.

HAZARDS OF MINE FIRES

The disastrous fires in bituminous-coal mines, particularly during 1944, have emphasized to mine management, mine employees, and State, Federal, and other agencies charged with improving mine safety the importance of preventing fires and the need for adequate fire-fighting facilities if repetition of similar occurrences is to be avoided.

A tremendous toll in lives has been taken by asphyxiation or by explosions caused by fires in mines, and unestimable property damage has resulted from them. With the exception of explosions, fires in coal mines are feared and dreaded more than anything else by everyone connected with the industry. This is because a mine fire not only may jeopardize the lives of everyone in a mine, but it usually causes heavy property damage, loss of production, and disorganization and demoralization of the entire operation. All mine fires are small when they start and are readily extinguishable in their incipient stages by direct attack with water, chemicals, rock dust, or sand, if such facilities are readily available and are promptly and properly used. From past experience, it is evident that in order to extinguish a fire by direct attack it must be reached, with adequate facilities, in its early stages. Failure to extinguish fires by direct attack is usually due to late discovery, lack of water or means of applying it promptly and effectively, lack of adequate fire extinguishers or other facilities, or improper procedure in the initial or subsequent attack. Hundreds of fires that were extinguished promptly and resulted in little damage to property or loss of production and no injuries or fatalities have occurred in mines. However, it is well-known that when a mine fire is not extinguished quickly, a chain of events usually follows that may result, as it has often in the past, in extensive property damage, large loss of production, asphyxiation of men, a disastrous explosion, or the necessity of sealing a portion of the mine or the entire mine. Moreover, it must be remembered that sealing and unsealing operations, particularly in a gassy mine, are always definitely hazardous. Suggested procedures for fighting, sealing, and unsealing mine fires have been discussed in several publications issued by the Bureau of Mines.

The potential hazard of a fire is present at all times in all coal mines, particularly in mines that are electrified, as there are many miles of trolley wires and bare feeder wires in any fairly large mine, every foot of which is a definite fire hazard. The importance of mine-fire hazards should be recognized by all persons concerned, particularly the higher officials of mining companies, and everything possible should be done to prevent them. Moreover, adequate fire-fighting facilities and adequate ways and means for the escape of workmen in case of fire should be provided in all mines. Probably as a result of many fires that reached highly serious proportions and the fatalities that resulted from such fires in 1944, efforts to reduce the occurrence of fires and contributing hazards have been more active and direct. Improvements are evident, particularly in some of the larger bituminous-coal mines in western Pennsylvania, and the same probably is true of other parts of the country. However, much remains to be done, and the seriousness of the hazards of mine fires should continue to be emphasized strongly.

SERIOUS RESULTS OF MINE FIRES

Mine fires in bituminous-coal mines have resulted in:

1. The exposure of workmen to the hazards of fighting the fire by direct attack for days and even weeks, at great expense.

2. Lives have been lost by those engaged in fighting mine fires and during recovery work by roof falls or asphyxiation, sometimes while wearing breathing apparatus.

3. Sixty-six men lost their lives in an Ohio mine in 1944; 259 men were killed in an Illinois mine in 1909; and in other instances as many as 20 fatalities have resulted from asphyxiation.

4. Numerous explosions have occurred during and after sealing. Many of these did not result in fatalities or injuries, but as many as 59 men have been killed at one time while sealing a mine fire.

5. Explosions also have occurred during unsealing work. Some of these did not result in fatalities or injuries, but as many as 10 men were killed at one time during unsealing and subsequent recovery operations.

6. In some of the recent disastrous mine fires in bituminous-coal mines, the cost of fighting the fire, sealing and unsealing operations, property damage, loss of production, recovering equipment and the affected portion of the mine, and compensation payments have ranged from thousands of dollars to well over a million dollars. Moreover, many lives were lost, and these, of course, were of much greater importance and value than the financial costs.

The above definitely shows that mine fires may and do result in extensive loss of life and great financial cost.

FIRE-FIGHTING FACILITIES

Water is still the most generally available and one of the best, if not the best, means of extinguishing most fires and should be available for fire-fighting purposes in every large or medium-size mine. However, many mines are located where a constant adequate supply of water is not available from streams, lakes, or ponds on the surface or from underground sumps. In such cases, unless deep wells can be utilized to furnish the necessary water, surface storage tanks containing an emergency supply of 50,000 gallons or more should be provided. Water lines of adequate size should be extended from the water supply to all portions of the mine to assure an ample supply of water for fire-fighting purposes in any part of the mine. The installation of water lines in mines may appear to some persons to be unnecessary and an unwarranted expenditure, but when the cost of even a relatively small fire is considered, with its attendant possible loss of production, property damage, and loss of life, the cost of such a water line may be relatively small. Moreover, the water lines provided for fighting fires can also be used to supply water to allay dust formed during mining. Hydrants or hose taps should be installed near shaft bottoms about every hundred feet and installed along water lines between the bottom of the shaft or slope and the working sections at intervals of not more than 500 feet. Fire hose adequate in size (not less than 2-inch) and quantity should be stored on reels in stations at strategic locations throughout the mine. Nozzles, preferably adjustable for a stream or fog, Siamese hose couplings, fittings, tools, lumber, nails, brattice cloth, and several bags of rock dust should also be kept at the stations or where the hose is stored.

In mines not equipped with water lines (and as auxiliary equipment in mines having water lines), mobile fire cars containing several hundred gallons of water and equipped with suitable pumps, hose, and other pertinent equipment, or chemical trucks, should be provided. However, the effective use of track-mounted fire cars or trucks is limited in many mines, and difficulty may be experienced in moving such equipment from the place of storage to the fire, because of obstructions such as locomotives, loaded and empty cars, mining and loading machines, and other equipment.

Portable fire extinguishers should be provided at strategic locations on the surface and throughout the mine, and the practice of some companies of equipping each unit of mobile electrical equipment with a fire extinguisher to provide a quick and ready means of extinguishing incipient fires certainly has merit. However, caution must be observed in the use of some fire extinguishers, particularly in places that are not well ventilated, because of noxious fumes they generate. The installation of the best available fire-fighting facilities probably will be of no great value, unless capable personnel is selected and trained to use them. A plan of procedure to be followed in the event of a fire, which includes the prompt withdrawal from the mine of all employees not engaged in fire fighting, should be established, and all officials and other keymen should be fully instructed in their duties and responsibilities. Such procedure and training of personnel have been discussed in several Bureau of Mines publications. A predetermined course of action and training therein may save many precious minutes in the early stages of a fire. In too many cases the lack of such a plan and the consequent delay in combating a fire, although extinguishers, water lines, outlets, and hose and nozzles were available, resulted in the fire reaching such proportions that many men lost their lives, and the fire had to be sealed to control it.

Many mining companies, particularly the more progressive ones, because of lessons learned from past disastrous fires, are making a commendable effort to prevent fires by more carefully installing, maintaining, and inspecting electrical equipment and by giving more thought and attention to other fire hazards. The more modern mines also provide adequate means for fighting fires in the event they occur. The fire-fighting facilities provided at four large or fairly large western Pennsylvania bituminous-coal mines are described and illustrated herein. Two of these (Indianola and Springdale) are captive mines, and the other two (Renton No. 3 and Montour No. 10) are commercial mines.

Indianola Mine
Republic Steel Corp.
Indianola, Allegheny County, Pa.

The Republic Steel Corp., which operates coal mines in Pennsylvania, West Virginia, Kentucky, and Alabama, has in effect a large program for equipping its mines with facilities and equipment for controlling fires that might occur in the future. As the program is more nearly complete at Indianola mine than at some of the other mines of the corporation, the study was made there.

The operating officials at Indianola mine are:

G. D. Wyant	Superintendent	Indianola, Pa.
Charles O'Brien	Mine foreman	Indianola, Pa.
Ira Lacey	Chief electrician	Indianola, Pa.
P. T. Yeloushan	Safety inspector	Indianola, Pa.

The Indianola mine, at Indianola, Allegheny County, Pa., is opened by two shafts and is connected to the Russellton mine of the same corporation. The mine is developed in the Upper Freeport coal bed, which in this mine

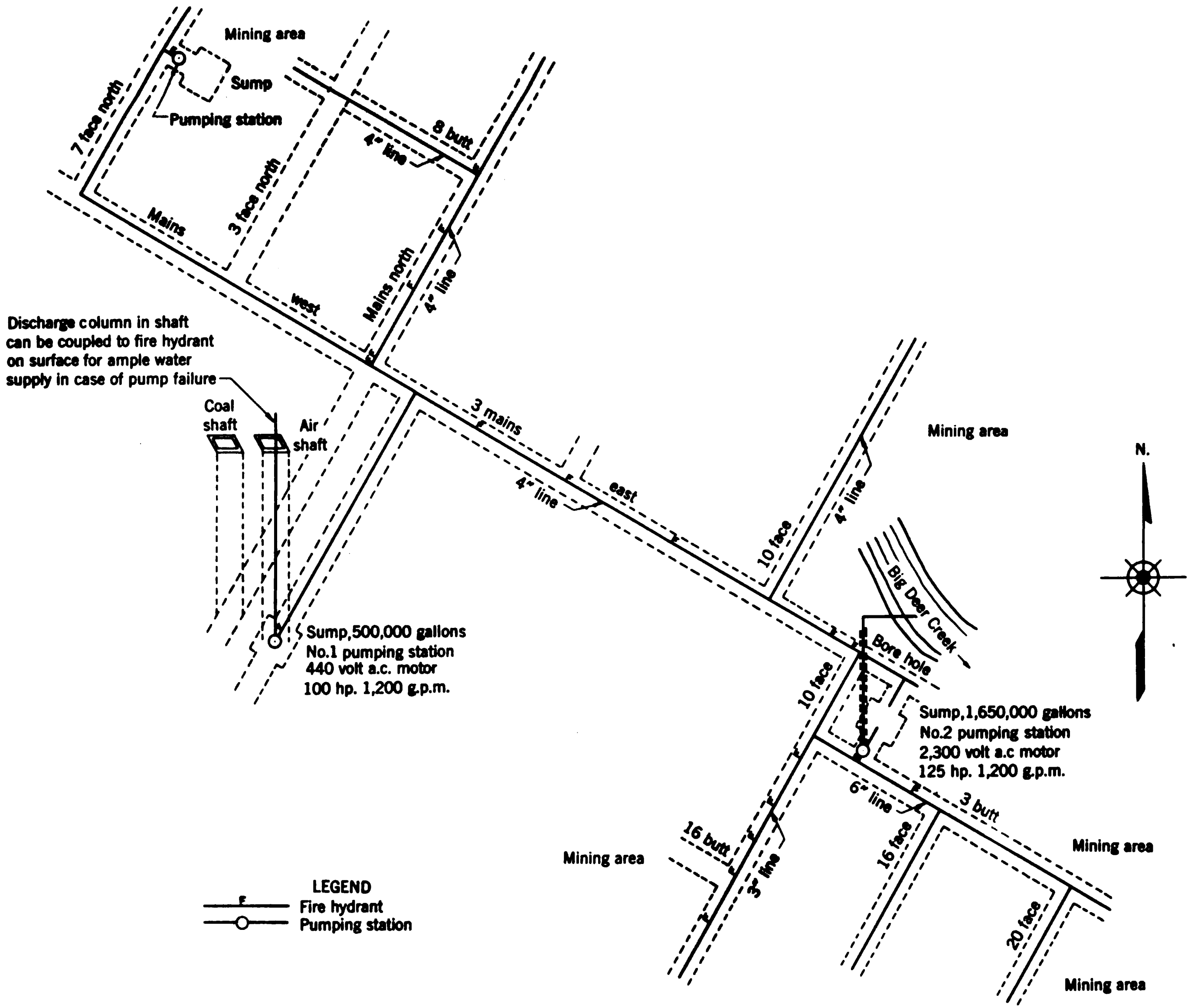

Figure I. - Diagram of water system. Republic Steel Corp., Indianola mine.

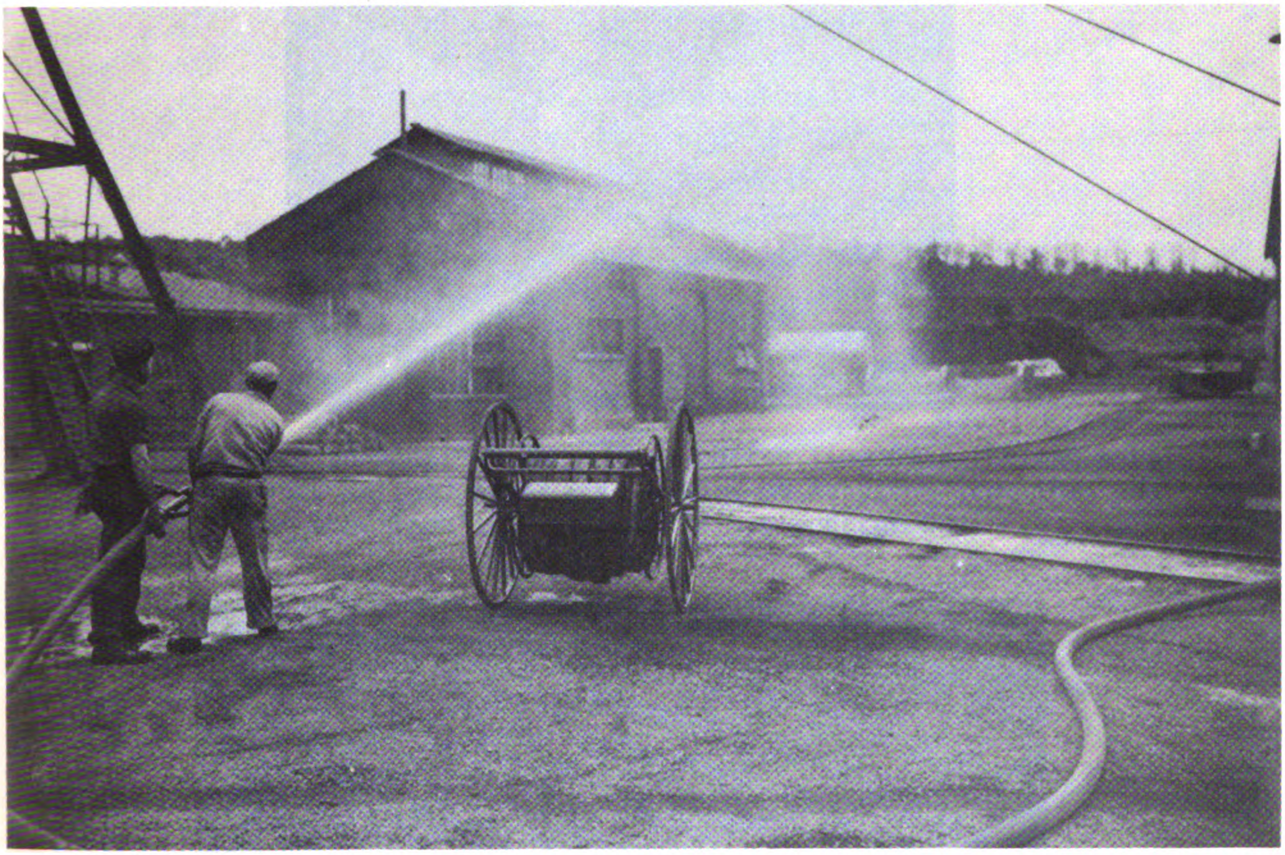

Figure 2. - Water stream through adjustable nozzle. Water and pressure supplied by Indianola's municipal water system.

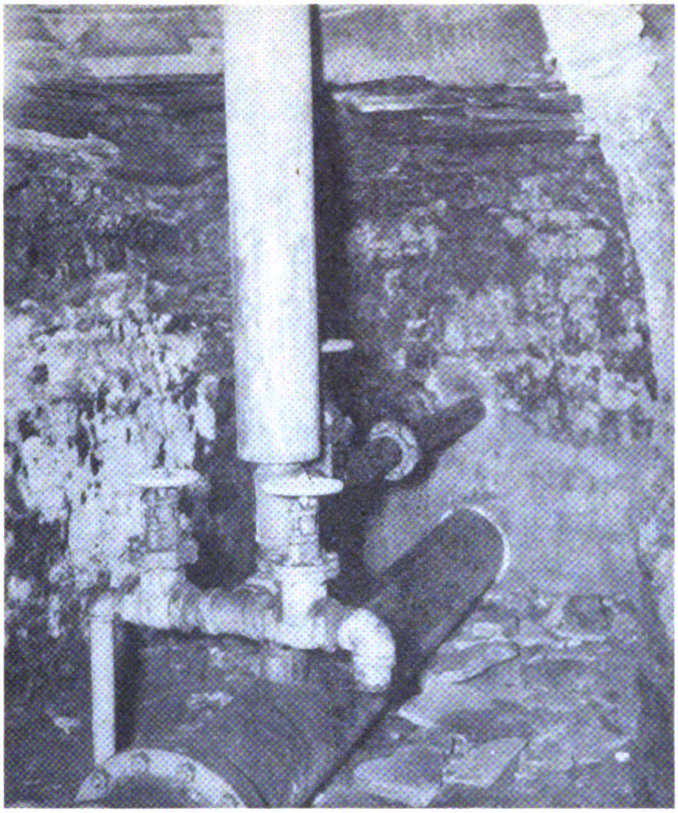

Figure 3. - Pipe connections on main discharge line near the man-supply shaft bottom. Water and pressure are supplied from this point for the fire-fighting water lines underground.

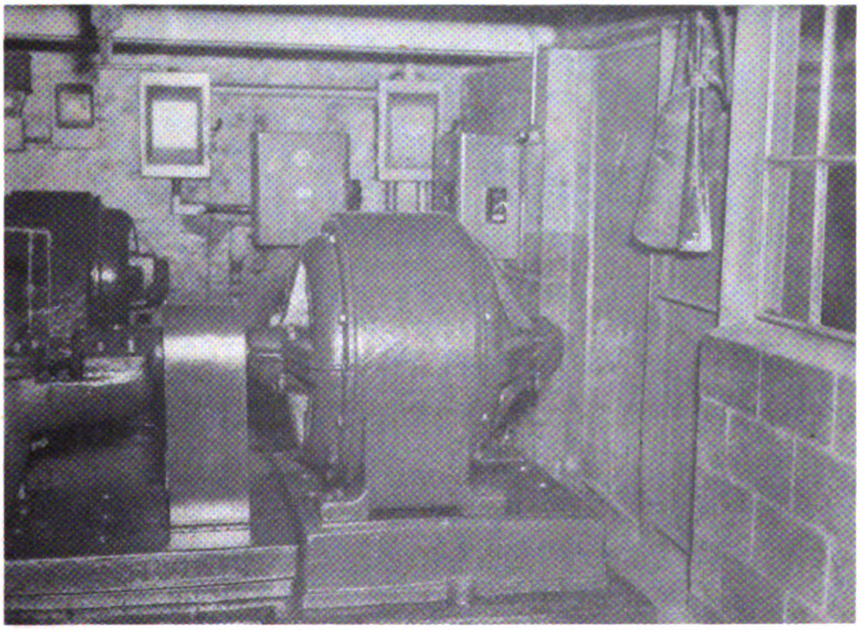

Figure 4. - Main pumping station near man-supply shaft bottom. Room is of fire-proof construction, wiring in conduit, and equipped with a CO_2-type fire extinguisher.

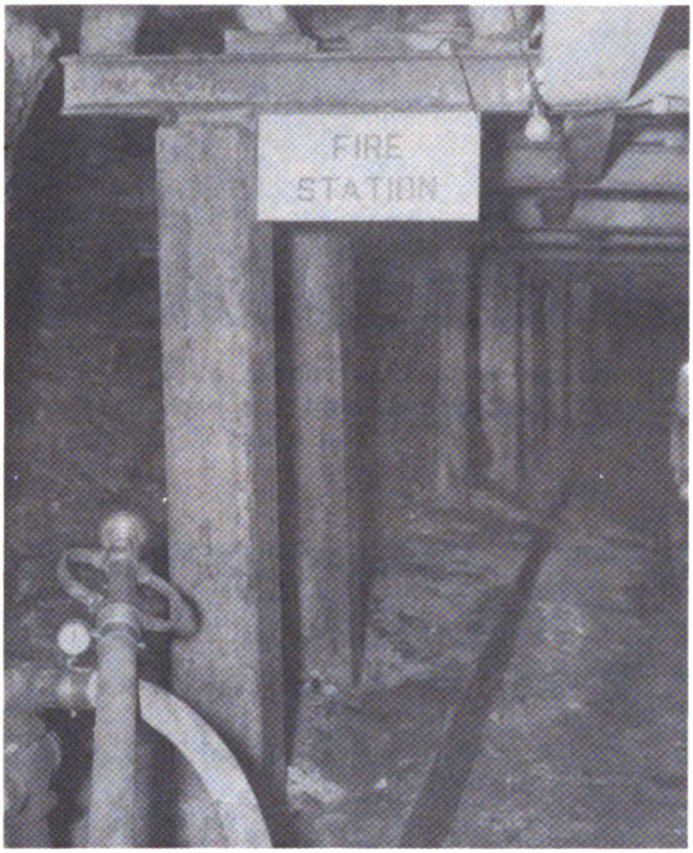

Figure 5. - Fire station along a panel-main entry underground. Note fire plug and water line.

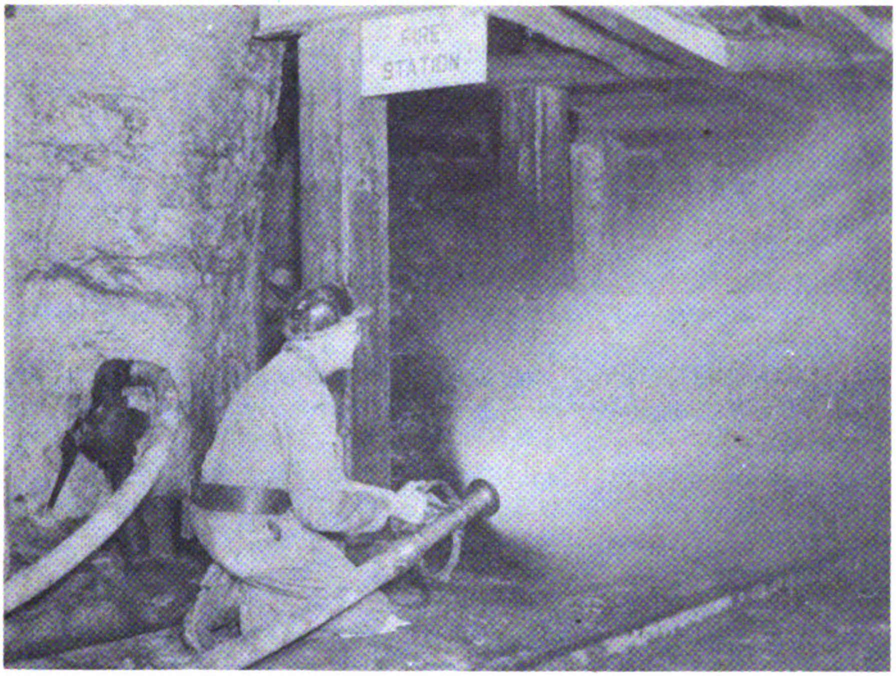

Figure 6. - Fire plug along panel-main haulage road with fire hose and nozzle attached. Note fog from the adjustable nozzle.

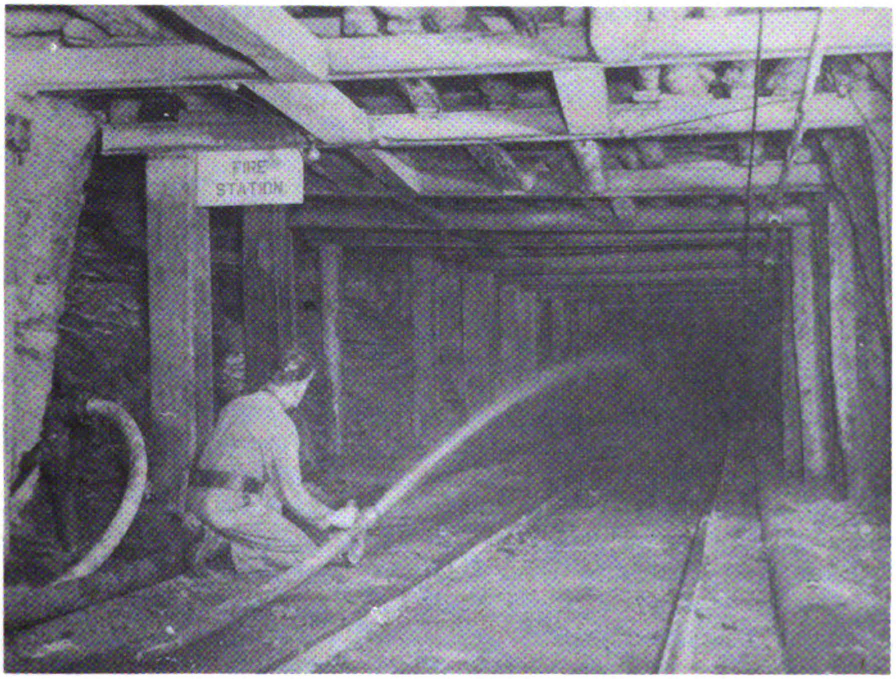

Figure 7. - Another view of a fire plug, hose, and nozzle under pressure. Distance from nozzle to end of water stream approximately 75 feet.

averages 75 inches in thickness. A total of 670 men is employed, of which 530 work underground on three shifts. The average daily production is about 3,800 tons of coal, all of which is loaded by mobile loading machines.

The mine is classified gassy by the Pennsylvania Department of Mines. All track-mounted mining machines, drills, and other electrical face equipment are the permissible type.

With the exception of one section where shuttle cars are used, coal is gathered by cable-reel locomotives and hauled to the shaft bottom by trolley locomotives. The coal is dumped into a bin at the shaft bottom and hoisted to the surface in skips. Men are transported between the man-and-supply shaft bottom and the sections in covered steel man-trip cars.

The facilities and equipment for controlling fires on the surface and underground at the Indianola mine are as follows:

Surface

The water lines on the surface are connected with the municipal water system (see fig. 1). The water pressure at the mine tipple is more than 100 pounds per square inch at the fire hydrants. Fire plugs, hose on reels (see fig. 2), and a combination adjustable fog-and-fire-stream-type nozzle are provided, maintained, inspected, and tested several times a year. In addition to this equipment, hand-operated portable fire extinguishers are provided throughout the tipple, shops, hoist rooms, and other buildings. Most of the surface buildings, particularly those near the mine shafts, are of fireproof construction.

Underground

Pumping station No. 1 for the mine (see fig. 1) is near the man-and-supply shaft bottom. The sump at this station has a capacity of about 500,000 gallons. Two 1,200-gallon-per-minute centrifugal pumps that are driven by 100-horsepower, 440-volt, alternating-current motors are maintained in this station. Pipe-line connections and valves (see fig. 3) are provided on the discharge line of this pumping station (see fig. 4) for the purpose of supplying water under sufficient pressure for controlling fires in the mine. A 4-inch pipe line extends from this pumping station a distance of 12,050 feet along a main haulage road toward the working sections. Fireplugs (see figs. 5, 6, and 7) are provided on the line at 800- to 1,000-foot intervals.

Pumping station No. 2, which houses a 1,200-gallon-per-minute centrifugal pump driven by a 125-horsepower, 2,300-volt, alternating-current motor, is about 3,000 feet from the extreme end of a main haulage road between and near two large sections (see fig. 1). The sump at this station has a capacity of approximately 1,650,000 gallons. Normally, water is pumped to the surface from this station through a 4-inch pipe in a borehole. The power circuit for this station is independent of the mine circuit.

Facilities such as valves, bypasses, and other connections have been provided to utilize the impounded water for fire-fighting purposes, if needed. A

6-inch line extends 2,300 feet toward the mine's regular fire line. About 4,800 feet of 2- to 3-inch pipe line is used to connect the aforementioned station to complete the fire line. It was stated by an official that in the event of a fire, particularly along the haulage roads, water would be supplied from station No. 1. However, water under high pressure is available from station No. 2, if needed. In the event that the water in the underground sumps was not sufficient to extinguish a fire, water from the municipal water system, obtained from the Allegheny River, can be turned into the mine through connections at station No. 1.

Pressure readings that were taken during the study showed more than 100 pounds per square inch at the plugs tested.

About 3,000 feet of 2-1/2 inch fire hose is kept on hand at the mine.

An adjustable-type nozzle is provided for underground use (see fig. 6). The nozzle can be adjusted to use either a fire-fighting stream or heavy fog for approaching a fire. It is claimed by persons who have had experience in the use of adjustable nozzles that water under pressure in the form of fog will effectively control the back surge of smoke and fumes. It will also reduce dangers of hydrogen explosion or steam scalds and reduce temperatures to degrees that will permit following up the advantages gained through the use of large quantities of water. It was also pointed out that the judicious use of the fog nozzle is a very definite and important factor in the extinguishing of any mine fire, and its use will permit direct attack on a fire that otherwise might not be approachable.

After the fire has been reached, the nozzle can be adjusted to play a fire-fighting stream of water on it. A Siamese coupling is also provided, so that, in the event it is needed, two hoses or streams of water may be supplied from a plug. If necessary, as is often the case, the amount of air reaching the fire could be reduced, and one person using the fog effect could keep smoke and fumes away from the person using the fire-fighting stream.

A fire-fighting car (fig. 8) is maintained in a specially constructed stall near the shaft bottom; it is equipped with a 40-hp., direct-current motor, centrifugal pump, 750-gallon tank for priming or fire fighting, 1,500 feet of 2-1/2-inch fire hose, Siamese coupling, fire-plug connections, two nozzles (one a fog type), telephone, tools, and a CO_2-type extinguisher. The pump will develop a pressure of 300 p.s.i. and can pump water from a ditch, sump, or the 750-gallon tank.

A chemical fire car (see figs. 9 and 10) consisting of two 75-gallon tanks charged with soda, acid and water and mounted on a truck, is maintained near the shaft bottom. The car is equipped with 75 feet of 1-inch hose and a nozzle. It is also equipped with a tipping arrangement that spills and mixes the ingredients in the tanks when put into service. The mixture comes out of the hose at 80 pounds pressure, and the charge will last about 20 to 25 minutes. The car can be used for incipient fires.

With the exception of locomotives, all portable equipment is provided with fire extinguishers, generally the CO_2 type. In addition to a fire extinguisher, two bags of rock dust are carried on each mining machine (see figs.

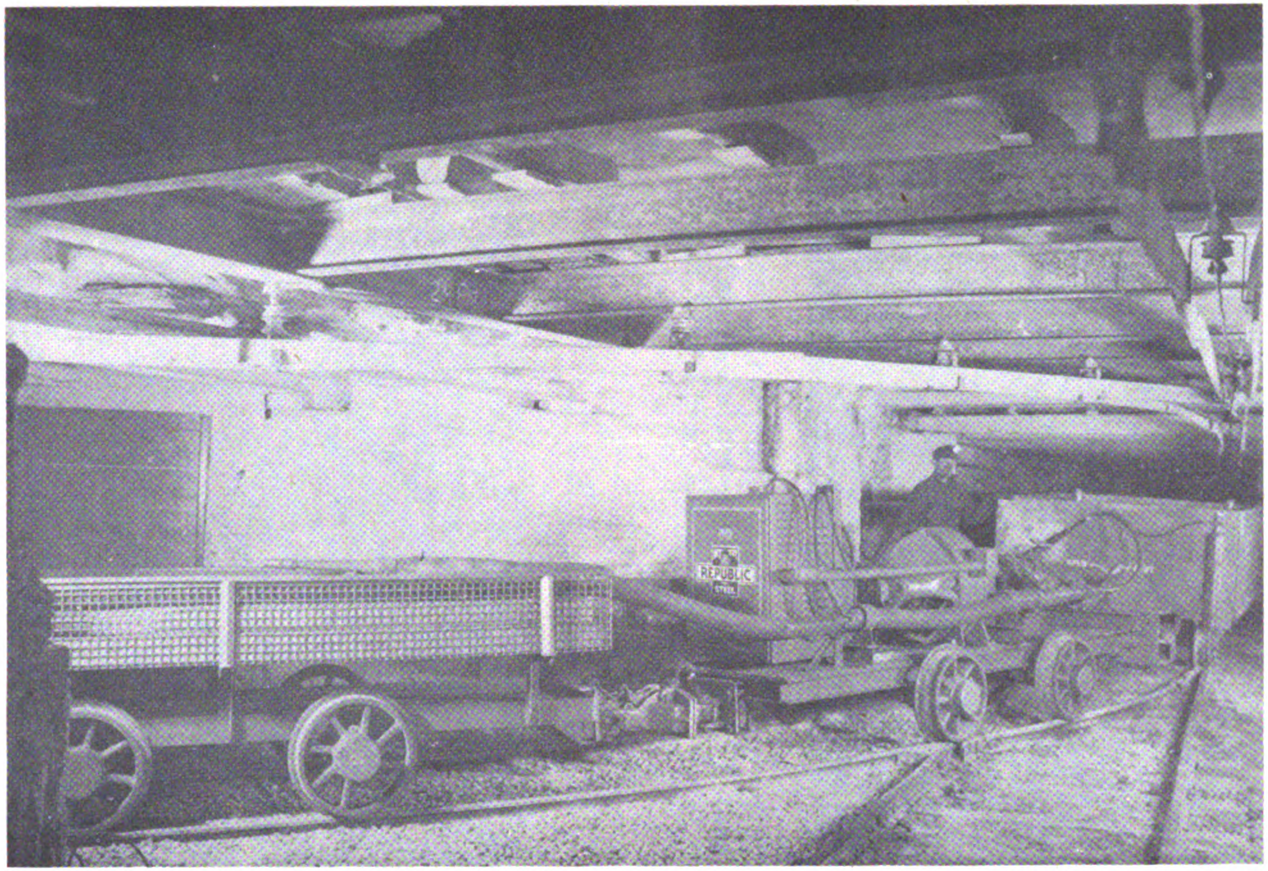

Figure 8. - Fire-fighting car equipped with a 40 hp. direct-current motor, large centrifugal pump, fire hose, nozzles, telephone, and tools. Car couplers are standard for the mine.

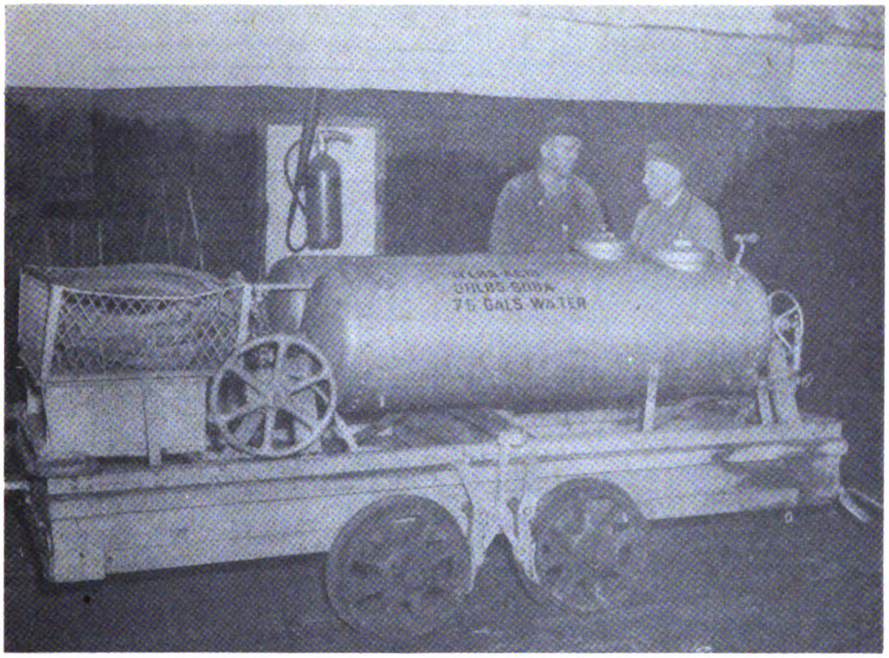

Figure 9. - Chemical fire-fighting car. The car is equipped with two 75-gallon-capacity tanks, 75 feet of 1-inch fire hose, and a nozzle.

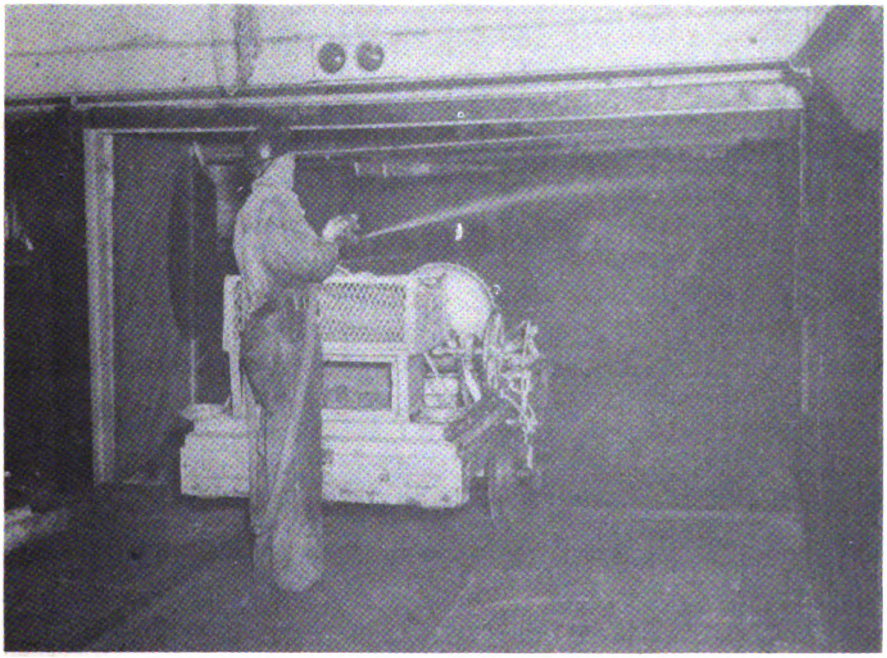

Figure 10. - End view of chemical car in operation.

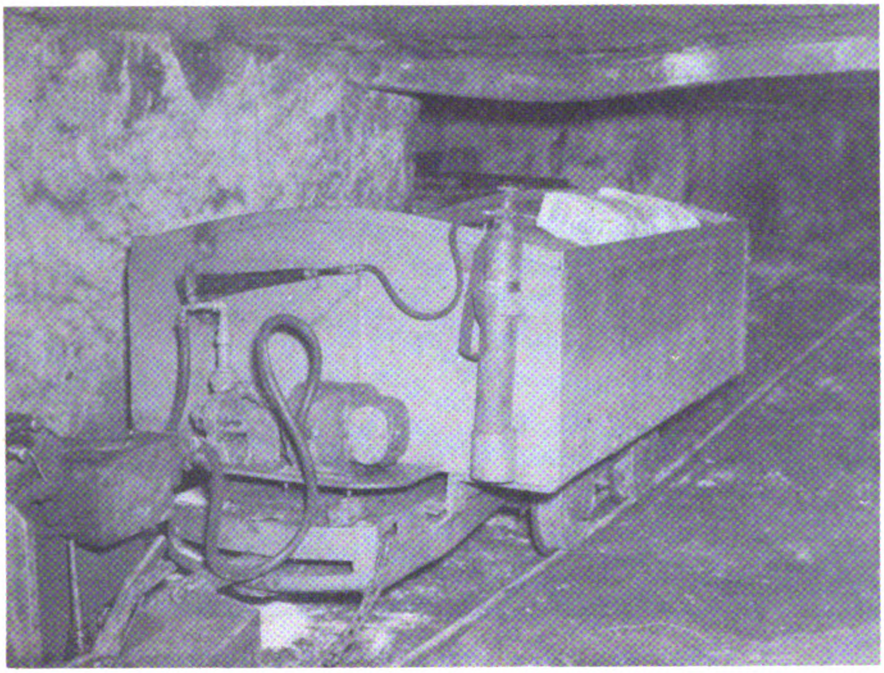

Figure 11. - Mining machine equipped with two bags of rock dust and a CO_2-type fire extinguisher. Water from the tank car is used to allay dust.

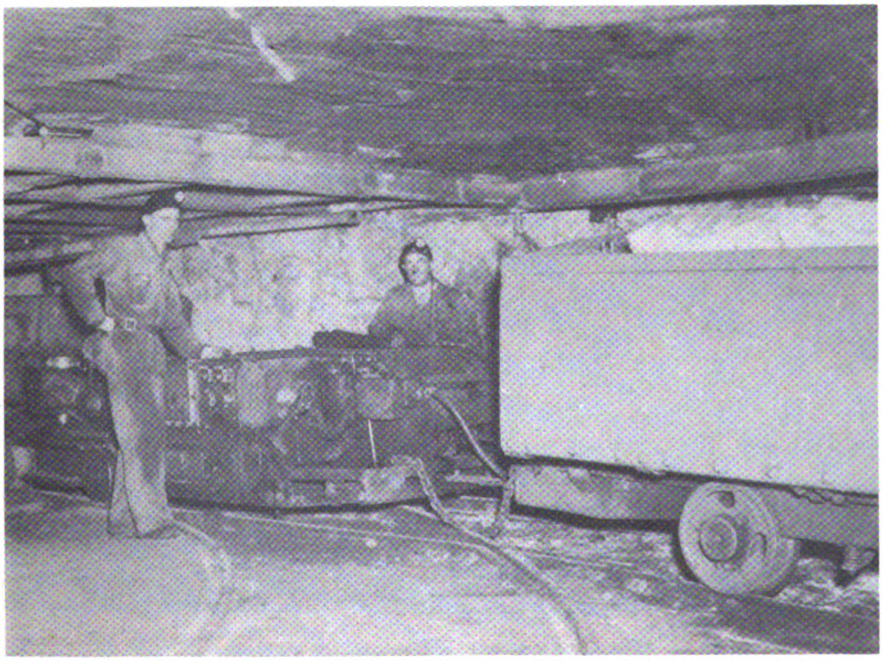

Figure 12. - Side view of a mining machine.

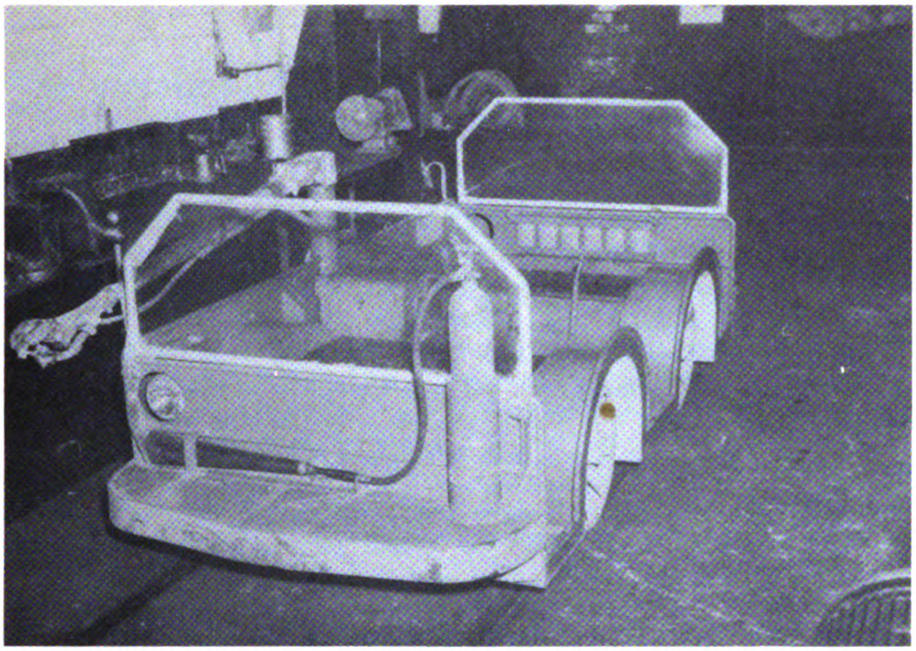

Figure 13. - Officials' "Jeep." This car is equipped with a large, hand-operated, CO_2-type fire extinguisher, 12 self-rescuers, and a first-aid kit.

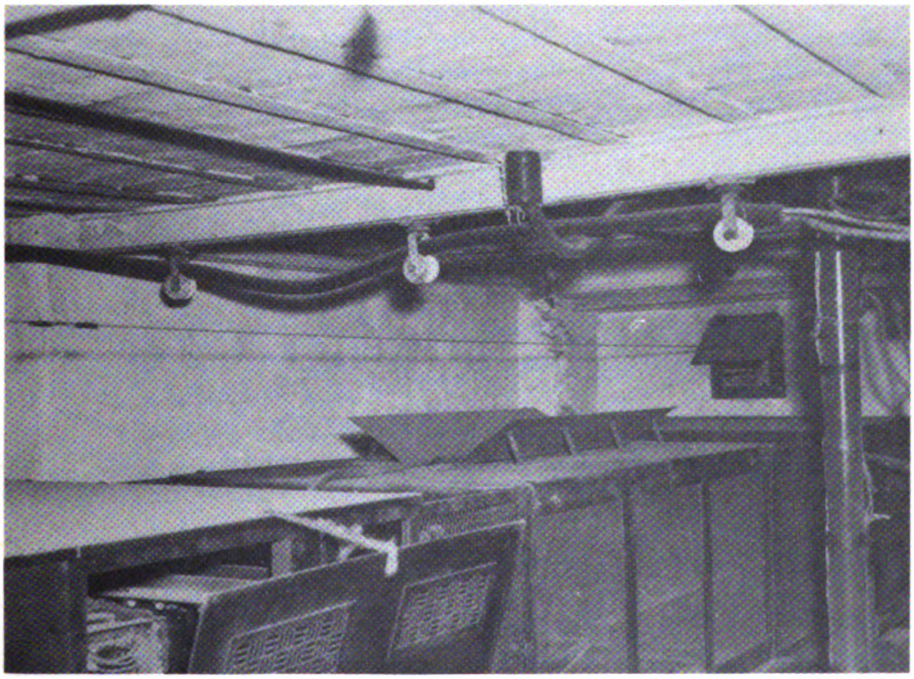

Figure 14. - Underground generator room equipped with fire-emergency doors. Note fuse-links in the line holding door open in normal operation.

11 and 12). The officials' "jeep" at this mine is equipped with a CO_2 extinguisher, 12 self-rescuers, and first-aid kit (see fig. 13).

All permanent pump rooms, rectifier rooms, and shops underground are of fireproof construction. The rectifier rooms are also equipped with automatic fire-emergency doors (see fig. 14). A fire extinguisher (CO_2) is maintained in each station, such as pump and rectifier rooms and shops. In addition to the extinguishers on the portable equipment, two large, portable, foam extinguishers and a large quantity of rock dust are maintained on each section. A high-pressure rock-dusting machine, together with a large quantity of rock dust, is kept in readiness for use in combating fires. All crews are instructed in the use of the fire-fighting equipment.

The officials of the Republic Steel Corp. realize that even the best mines have fire hazards, and they have, as indicated herein, made elaborate arrangements to control fires if and when they occur.

Springdale Mine
Allegheny Pittsburgh Coal Co.
Logans Ferry, Allegheny County, Pa.

The Springdale mine is owned and operated by the Allegheny Pittsburgh Coal Co. A local office is maintained at the mine, but the principal office is at 14 Wood Street, Pittsburgh, Pa. The operating officials of the company are:

H. L. Mitchell	President	Pittsburgh, Pa.
A. N. Cartwright	Vice president	Pittsburgh, Pa.
J. M. Connor	General superintendent	Pittsburgh, Pa.
J. S. Gelston	Mining engineer	Pittsburgh, Pa.
R. J. Walter	Resident engineer	Tarentum, Pa.
Arthur Hall	Superintendent	Oakmont, Pa.
John Hackett	Safety engineer	New Kensington, Pa.
R. E. Jones	Mine foreman	Logans Ferry, Pa.

The Springdale mine is opened by three shafts and a slope in the Upper Freeport coal bed, which in this area averages 84 inches in thickness. A total of 495 men is employed, of which 434 work underground on three shifts 6 days a week. The average daily production was 4,500 tons of coal, all of which was loaded with permissible-type mobile loading machines. Production for 1947 was 1,099,976 tons.

The Pennsylvania Department of Mines classes the mine gassy.

A room-and-pillar method of mining is followed. The coal is top-cut and sheared by track-mounted permissible-type mining machines. In fact, all electrical equipment used in the face areas is the permissible type. Coal is gathered by cable-reel locomotives in 8-ton, double-truck, steel cars and hauled under the Allegheny River through two entries, by trolley locomotives, to the shaft bottom. The coal is dumped into twin skips and hoisted to the surface. It is then transported to the West Penn Power Co.'s Springdale plant by means of large rubber conveyor belts. Men are transported between the slope bottom and the sections in covered steel man-trip cars.

The fire-fighting facilities and equipment at the Springdale mine are as follows:

Surface Water Supply

As will be observed from a study of the water-supply and pipe diagram (see fig. 15), water is supplied from the Allegheny River for dust-allaying and fire fighting in the tipple and part of the mine. The 100,000-gallon tank (shown in the diagram) is part of the Logans Ferry Village water system. This system is connected to a 4-inch pipe line extending down a bore-hole into the mine. The main 4-inch line is also connected to the plant's water system under the Allegheny River. This line extends along the main haulage road to the main motor barn and shop near the slope bottom. Another tank, with a capacity of 30,000 gallons of water (also shown in fig. 15), is provided on the surface at a borehole. This hole is 223 feet deep and fairly close to the majority of the working sections of the mine. A well 70 feet deep and a deep-well pump are provided near the tank. In the event that the water supply from the well is not sufficient, water can be pumped from a nearby creek to the tank. Water can also be obtained from a sump and pumping station near the bottom of the borehole. The pipe in the borehole is 6 inches in diameter.

Four fire-hose cars, each containing 300 feet of 2-1/2-inch hose and a portable 40-gallon chemical (soda acid) fire extinguisher, are maintained in fire-hose houses (see fig. 16) on the surface. Fireplugs are provided at strategic locations around the surface buildings.

All buildings within a radius of 200 feet of the mine openings are of fireproof construction. Hand-operated fire extinguishers are maintained in the tipple and all other surface buildings.

Underground Water Supply

A fireplug is provided on the 4-inch line, which extends from the tipple, at the shop and motor barn near the slope bottom. (See diagram.) About 300 feet of 2-1/2-inch fire hose on a reel and a nozzle (see fig. 17) are maintained at this point. There is approximately 150 pounds pressure per square inch at the fireplug.

An 80-gallon (see fig. 18) chemical (Foamite actuated by nitrogen stored in tanks) fire-fighting truck equipped with 200 feet of 3/4-inch hose, a nozzle, and tools is also maintained ready for instant use near the main haulage road at the slope bottom. A refill for the tanks and a large quantity of rock dust also are kept at this fire station in mine cars. Two All-Service gas masks are a part of this equipment. Several persons, including mechanics who work nearby, are trained in the proper use of the fire car and the gas masks.

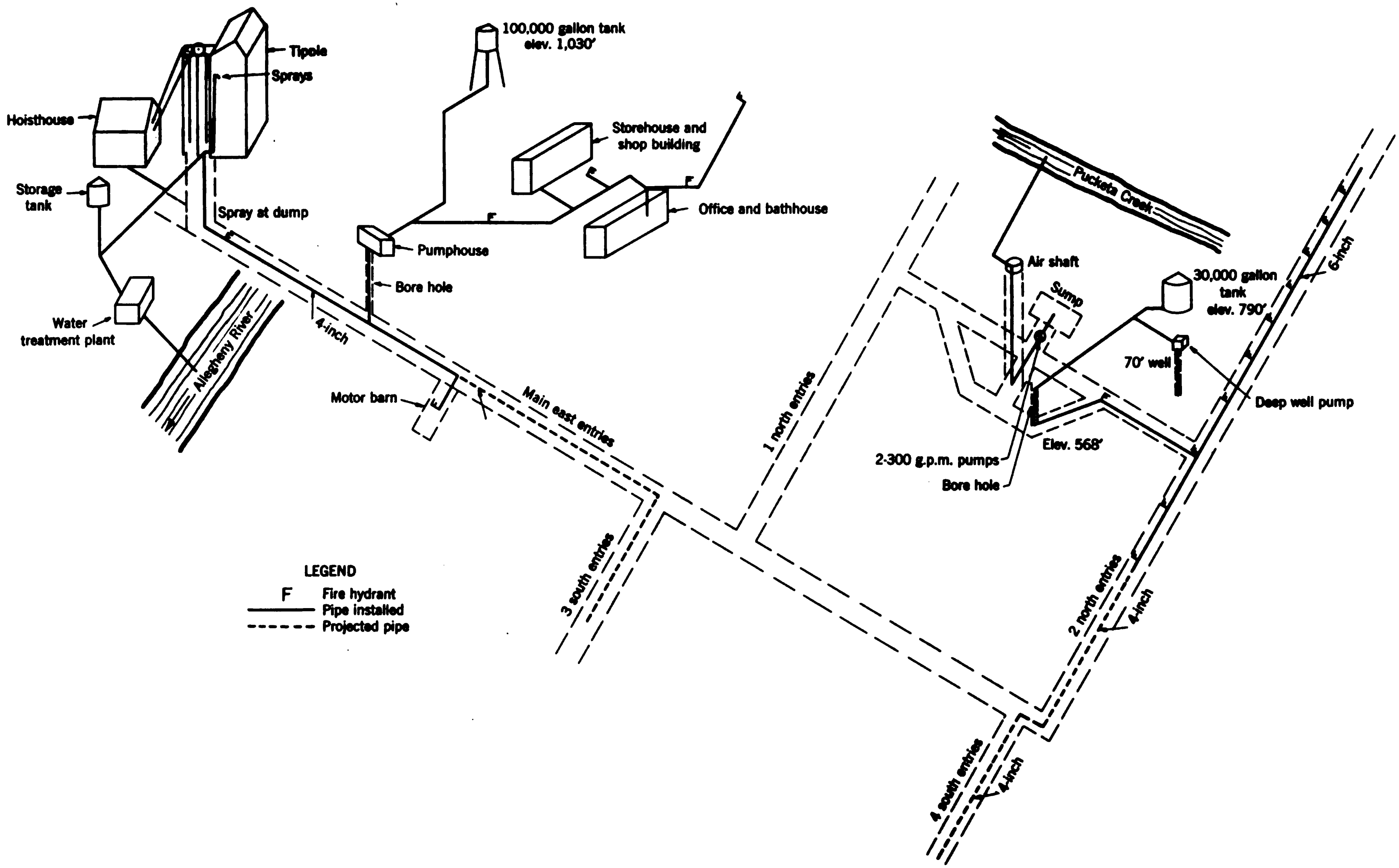

Figure 15. - Diagram of water system. Allegheny Pittsburgh Coal Co., Springdale mine.

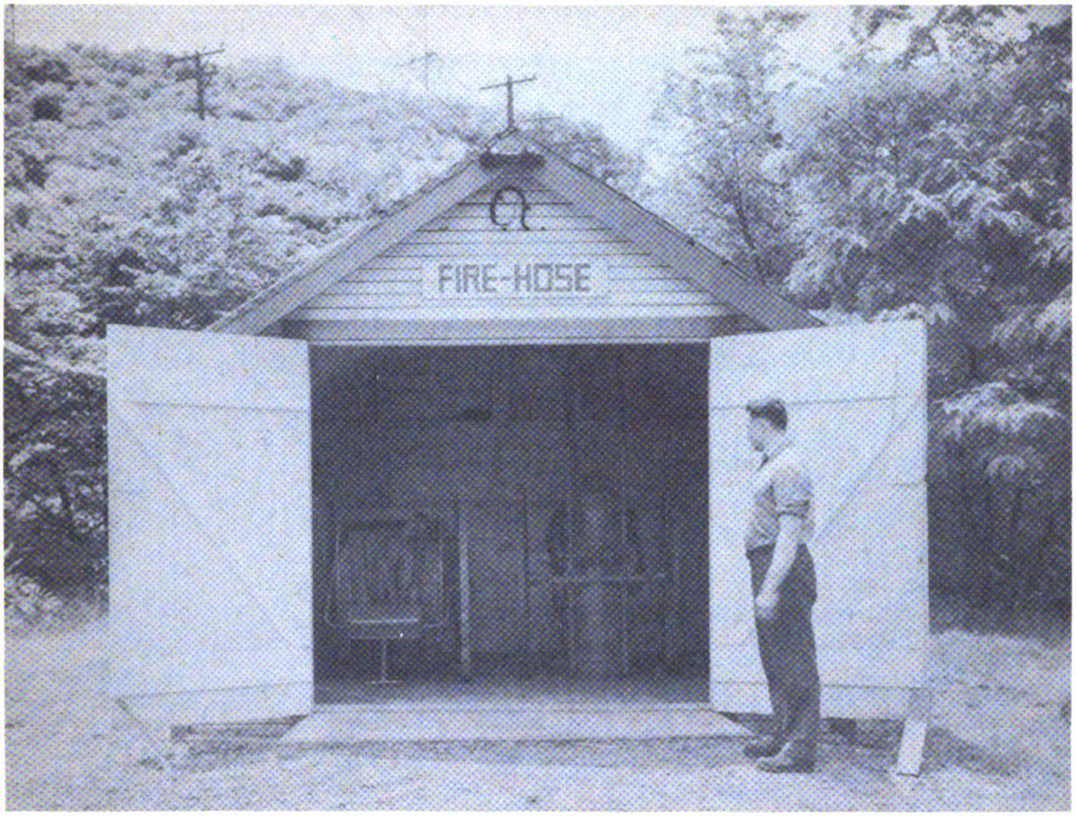

Figure 16. - Fire-hose house on surface containing fire hose and chemical tanks on trucks.

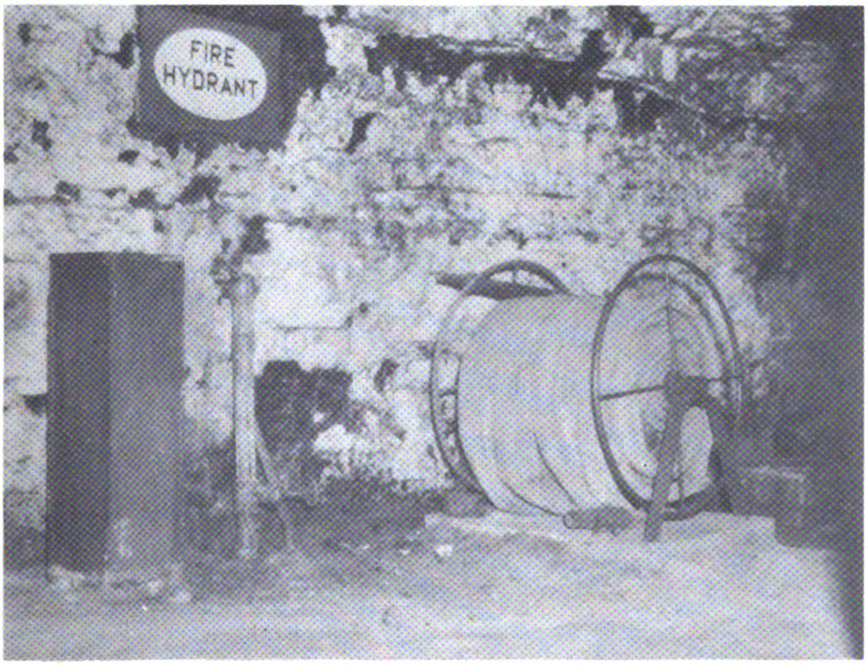

Figure 17. - Hose on reel and nozzle kept near underground motor barn.

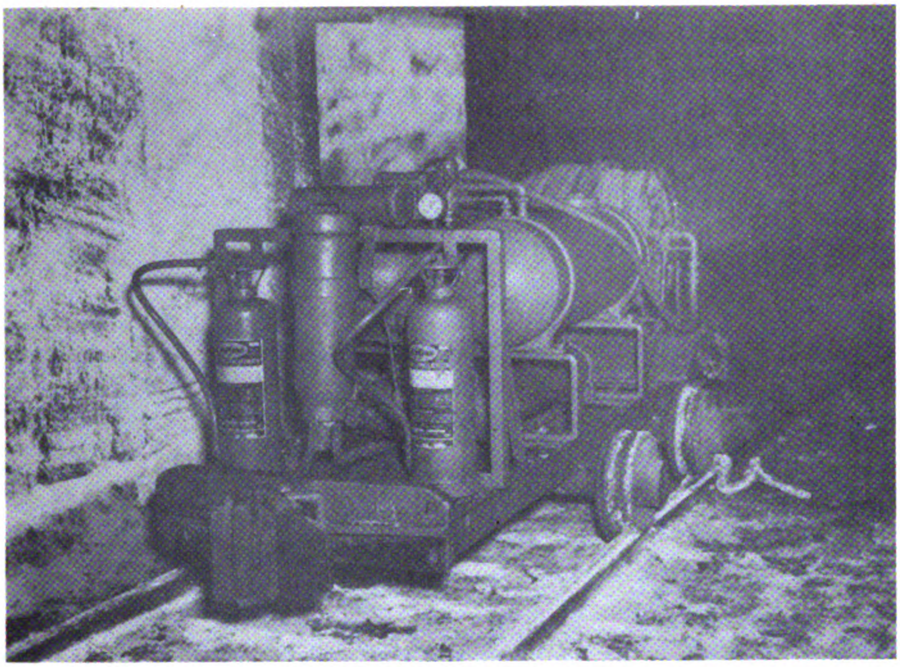

Figure 18. - View of track-mounted chemical fire truck.

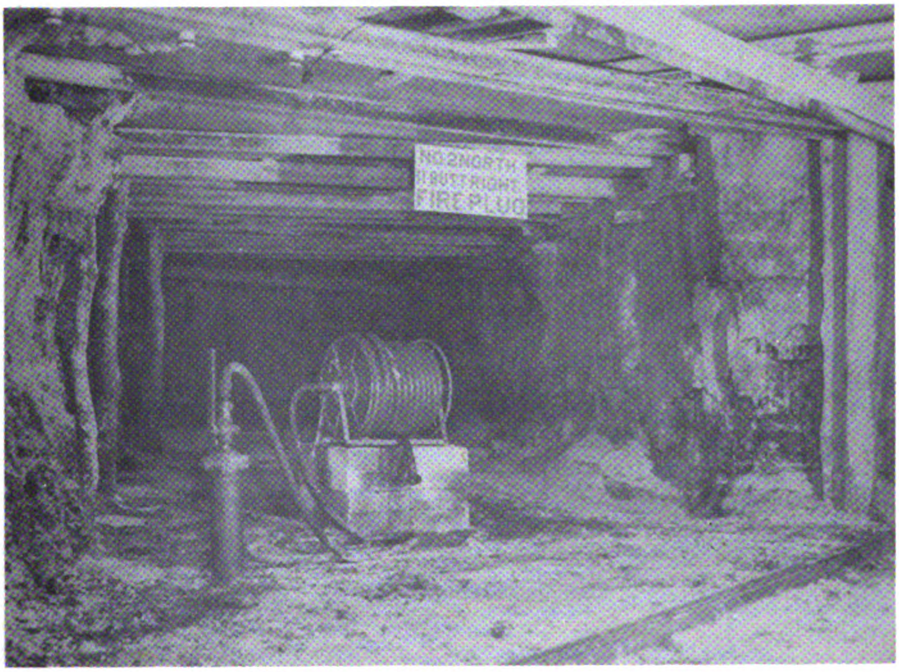

Figure 19. - Typical fireplug, hose, reel, and nozzle installed along water lines.

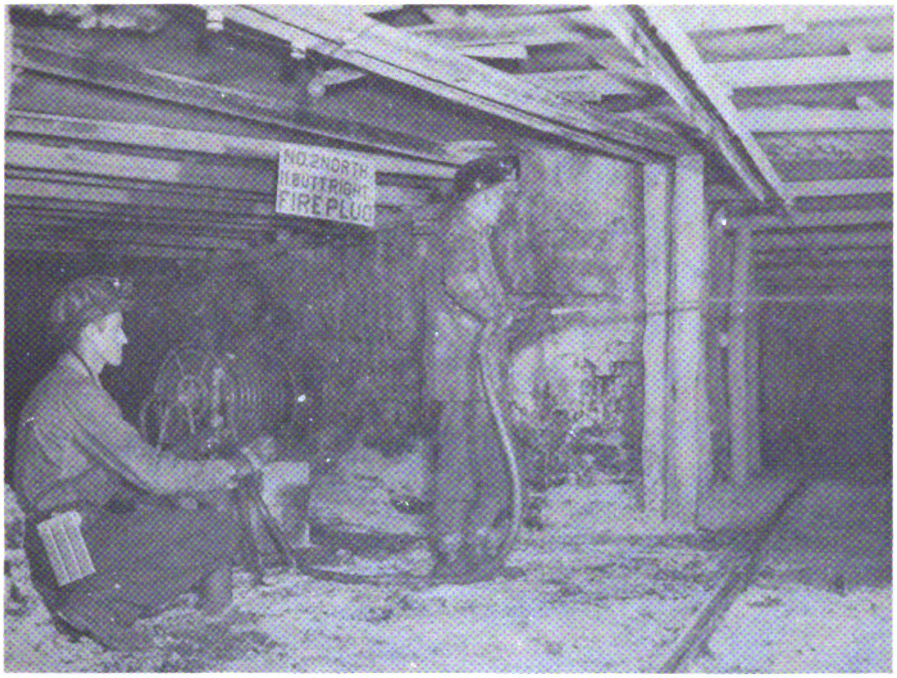

Figure 20. - Adjustable nozzle being used for constant stream.

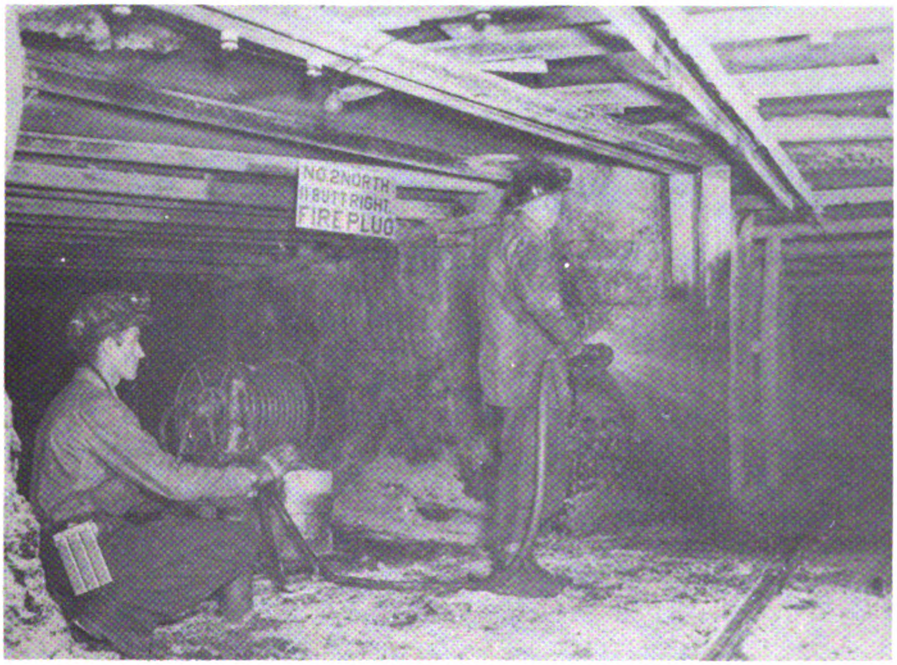

Figure 21. - Fog nozzle in action.

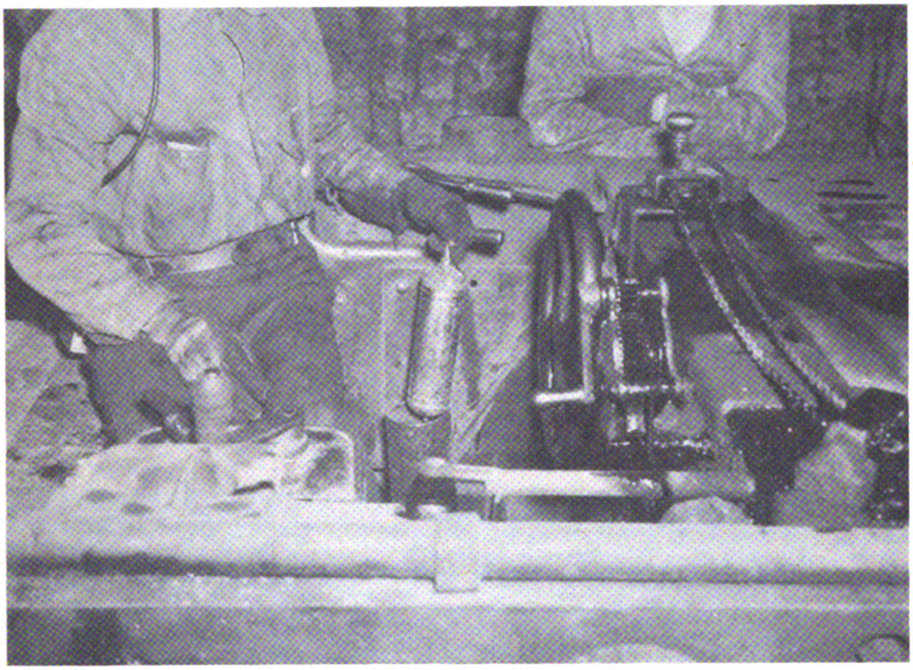

Figure 22. - Quart fire extinguisher carried on locomotive.

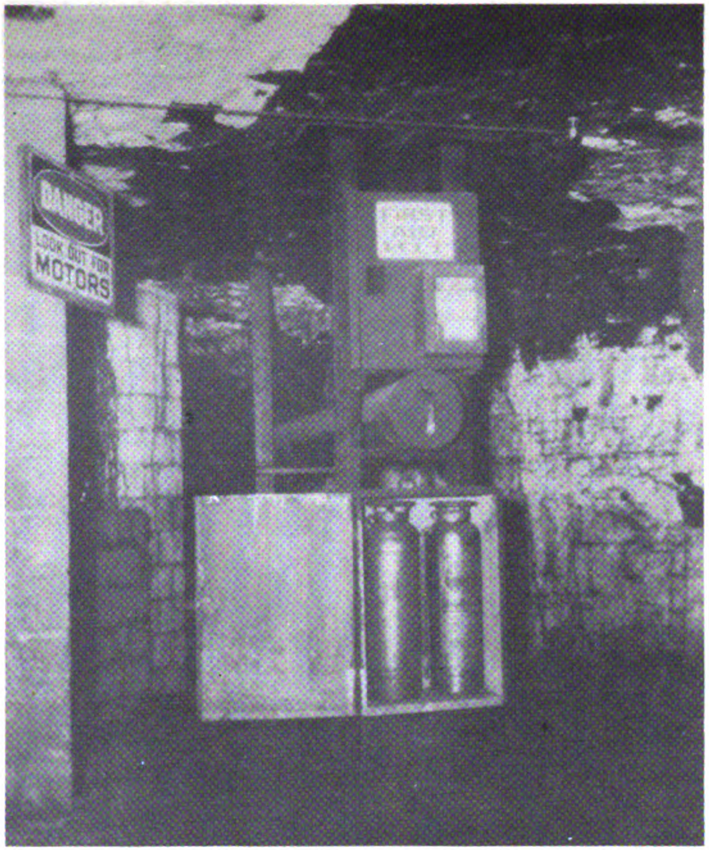

Figure 23. - 2-1/2-gallon fire extinguishers maintained at each first-aid station.

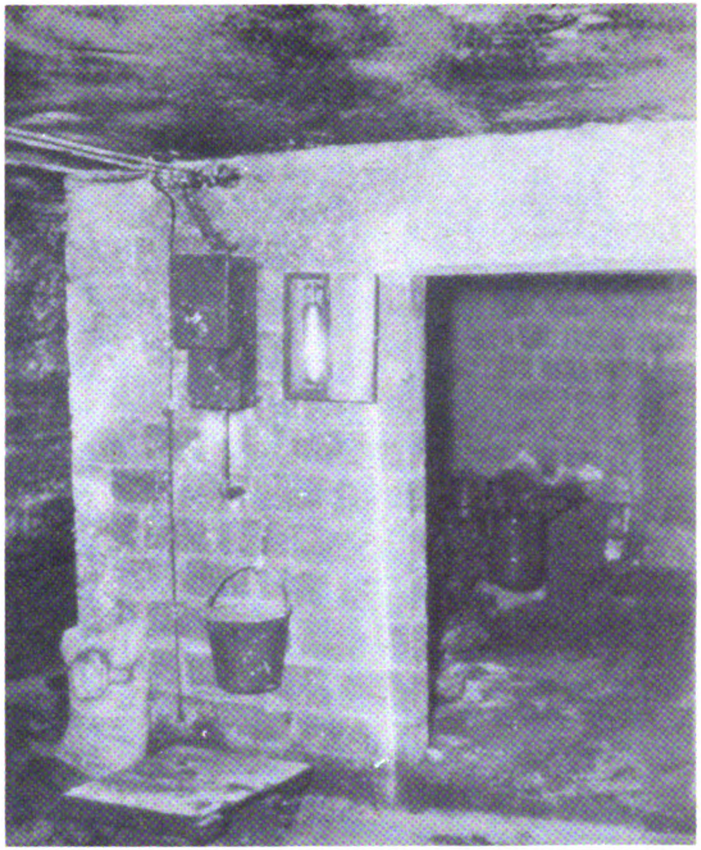

Figure 24. - Quart fire extinguisher and bag of rock dust maintained at small pump room.

Although the dust-allaying and fire-fighting program at the Springdale mine is not complete, owing to the scarcity of pipe, approximately 6,000 feet of 6-inch and 3,000 feet of 4-inch pipe lines have been laid to provide adequate dust-allaying and fire-fighting facilities. The 6-inch line extends from the bottom of the 223-foot borehole, mentioned previously, along the main, and the 4-inch lines are laid along panel mains. The management has plans to extend water lines to all sections of the mine when pipe is available. The joints of the pipe are connected with Victaulic couplings.

Gate valves are installed at all branch lines and at the bottom of the storage tank. Fireplugs (see fig. 19) are installed at approximate 475-foot intervals relatively close to the butt entries off the panel mains. Fire hose on a reel, tools, and nozzles (see figs. 20 and 21) are maintained underground. This fire hose is to be used on the hydrants or fireplugs along the pipe lines when needed.

A quart-size fire extinguisher (see fig. 22) is provided and maintained on each portable machine, such as mining and loading machines, locomotives, and other equipment. Five gallons of liquid (carbon tetrachloride) is maintained on each section for refilling the quart extinguishers when needed. A gallon fire extinguisher is maintained at each of the following places: main pump room, slope bottom, motor barn, and hoisting-shaft bottom. Two 2-1/2-gallon soda-acid fire extinguishers (see fig. 23) are maintained at each first-aid station. A first-aid station and kit are provided for each section. Foam-type fire extinguishers of 2-1/2 gallons capacity are located at strategic points along the main haulageways. A quart fire extinguisher, a bucket of sand, and a bag of rock dust (see fig. 24) are standard equipment for small pump rooms of a permanent nature.

A large supply of rock dust is kept in all sections and 200 bags of rock dust are kept in two mine cars ready to be dispatched to any point in the mine when needed. A high-pressure rock-dusting machine also is used and maintained in the mine.

No large fires have occurred in the Springdale mine. However, the officials of this company realize that a fire can start at any time, and they have made and are making a strenous effort to be able to control fires from any origin when and if they occur.

Renton No. 3 Mine
Pittsburgh Coal Co.
Renton, Pa.

The Pittsburgh Coal Co. of Pennsylvania owns and operates 17 coal mines in western Pennsylvania. This company is in the process of putting into effect a large program for installing and maintaining fire-fighting facilities and equipment in their coal mines. A study of the facilities and equipment for fire-extinguishment purposes has been made at two of this company's coal mines, namely, Renton No. 3 and Montour No. 10. The equipment, facilities, and plans at these mines are as follows:

Renton No. 3 Mine

A local office is maintained at the mine, an operating office at Library, Pa., and the main office is at Pittsburgh, Pa. The operating officials are:

G. A. Shoemaker	President	Pittsburgh, Pa.
H. C. Rose	Vice president	Library, Pa.
Thomas Ferguson	Division superintendent	Renton, Pa.
Clarence Hays	Chief engineer	Renton, Pa.
R. M. Penman	Superintendent	Renton, Pa.
R. H. Nicholas	Director of safety	Library, Pa.
Joseph Chillinsky	Safety inspector	Renton, Pa.
William Watson	Mine foreman	Renton, Pa.

The Renton No. 3 mine, at Renton, Allegheny County, Pa., is opened by three shafts. The mine is developed in the Upper Freeport coal bed, which averages 84 inches in thickness in this mine. A total of 376 men is employed, of which 315 work underground on three shifts. The average daily production is about 3,100 tons of coal, all of which is loaded by mobile loading machines.

Coal is cut by track and rubber-tired mining machines and is gathered by shuttle cars and cable-reel locomotives. It is hauled to the shaft bottom in 4-ton cars by trolley locomotives and is hoisted to the surface by an electric hoist and rope and dumped into the tipple. Six 38-man-capacity, covered, steel, man-trip cars have been delivered to the mine for transportation of men.

All the electric equipment used in the face areas is of permissible design. Although the program for equipping the mine with fire-fighting facilities was not fully in effect at the time this study was made, considerable progress has been made. The facilities for controlling fires in and around the mine are as follows:

Surface (Water Supply)

As shown on the diagram (see fig. 25) of the Renton No. 3 mine water system, two tanks (see fig. 26), one of which is constructed of steel and the other of wood, having a combined capacity of 116,000 gallons of water, are provided on the surface. The tanks are connected by a 4-inch pipe line. Water is supplied to the steel tank from four wells (see fig. 25) by means of deep-well pumps. Water is also available from the village water-system tank, which has a storage capacity of 56,000 gallons. Connections with the underground pumping station are provided to pump water to the wooden tank when needed. Two 6-inch lines extend from the wooden tank. One of the lines is used for water in the tipple, cleaning plant, and for fire protection of surface buildings (see fig. 27), and the other line is for the water supply for the underground fire-fighting system. Fireplugs (hydrants) are provided at strategic locations around the surface plant. Fire hose long enough to reach any part of the surface plant is maintained. The plant buildings are generally fireproof.

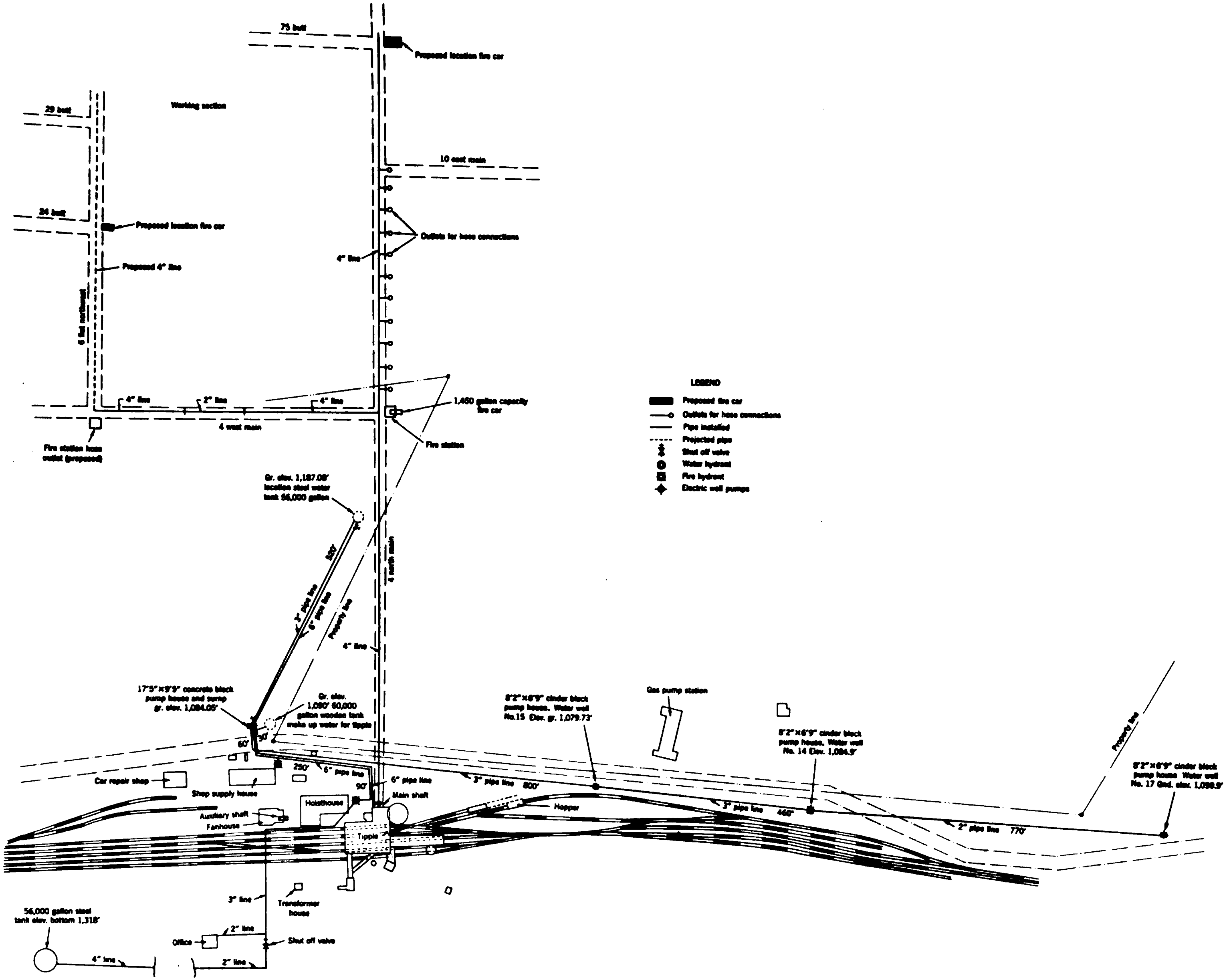
75 butt
Proposed location fire car
29 butt
Working section
10 east main
24 butt
Proposed location fire car
Outlets for hose connections
Proposed 4" line
4" line
6 flat northwest
LEGEND
Proposed fire car
Outlets for hose connections
Pipe installed
Projected pipe
Shut off valve
Water hydrant
Fire hydrant
Electric well pumps
4" line
2" line
4" line
1,460 gallon capacity fire car
4 west main
Fire station
Fire station hose outlet (proposed)
Gr. elev. 1,187.08' location steel water tank 56,000 gallon
530'
3" pipe line
6" pipe line
Property line
4 north main
4" line
17'5" × 9'5" concrete block pump house and sump gr. elev. 1,084.05'
Gr. elev. 1,090' 60,000 gallon wooden tank make up water for tipple
8'2" × 6'9" cinder block pump house. Water well No.15 Elev. gr. 1,079.73'
Gas pump station
8'2" × 6'9" cinder block pump house. Water well No. 14 Elev. 1,084.9'
Property line
8'2" × 6'9" cinder block pump house. Water well No. 17 Gnd. elev. 1,098.9'
30'
60'
250'
6" pipe line
6" pipe line
90'
Main shaft
3" pipe line
800'
Hopper
3" pipe line
460'
2" pipe line
770'
Car repair shop
Shop supply house
Hoisthouse
Auxiliary shaft
Fanhouse
Tipple
3" line
Transformer house
56,000 gallon steel tank elev. bottom 1,318'
2" line
Office
Shut off valve
4" line
2" line

Figure 25. - Diagram of water system. Pittsburgh Coal Co., Renton No. 3 mine.

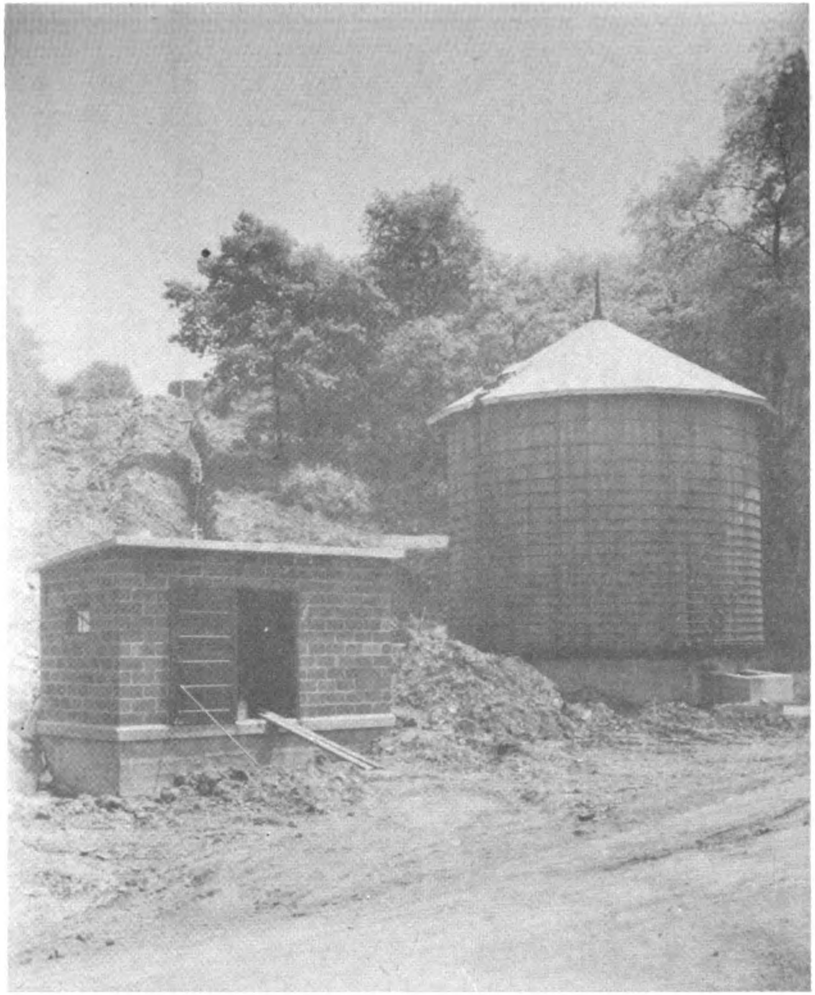

Figure 26. - Two tanks (one in extreme background) with a combined capacity of 166,000 gallons of water for tipple, cleaning plant, and fire-fighting purposes underground. Pump house under construction.

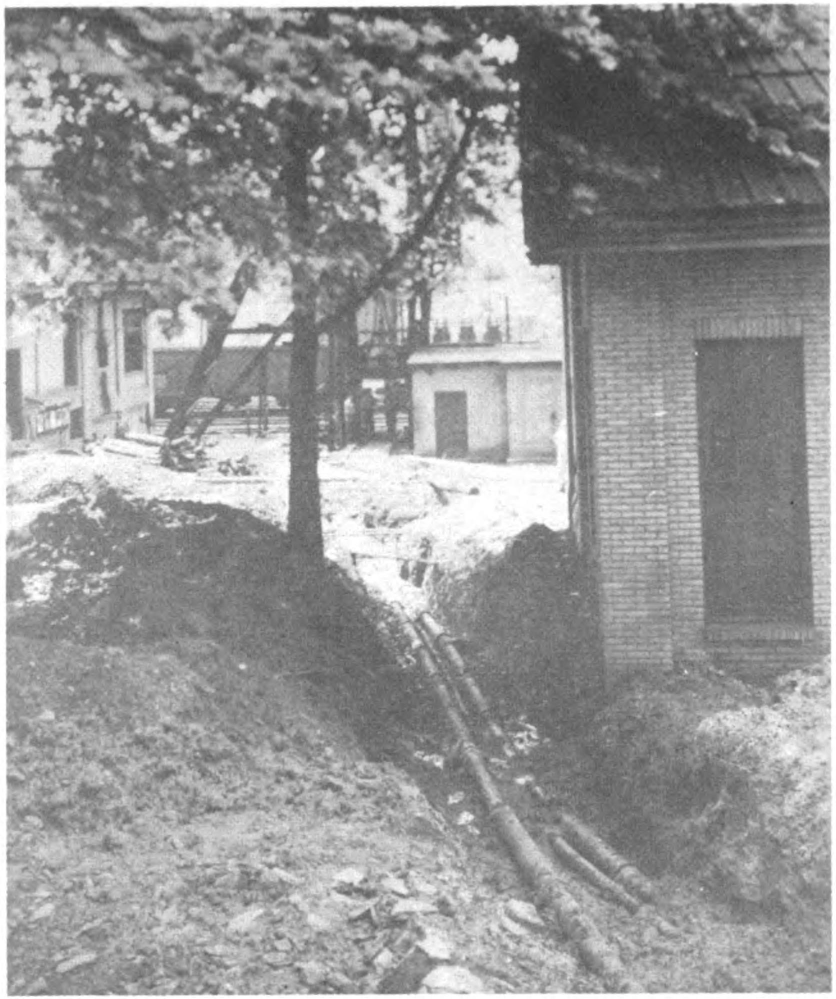

Figure 27. - Two 6-inch lines leading from tank, one of which enters the mine through the man-supply shaft.

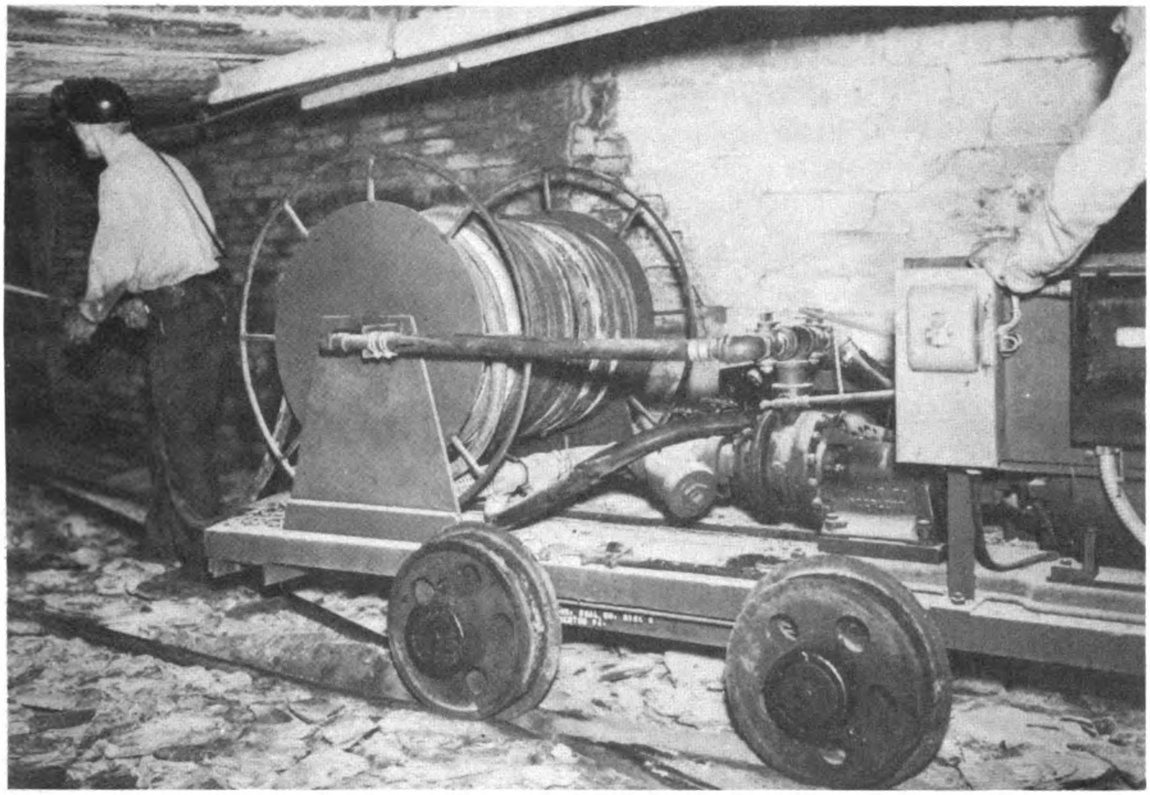

Figure 28. - Part of fire car that contains switches, motor, centrifugal pump, reel, and 500 feet of 1-inch hose.

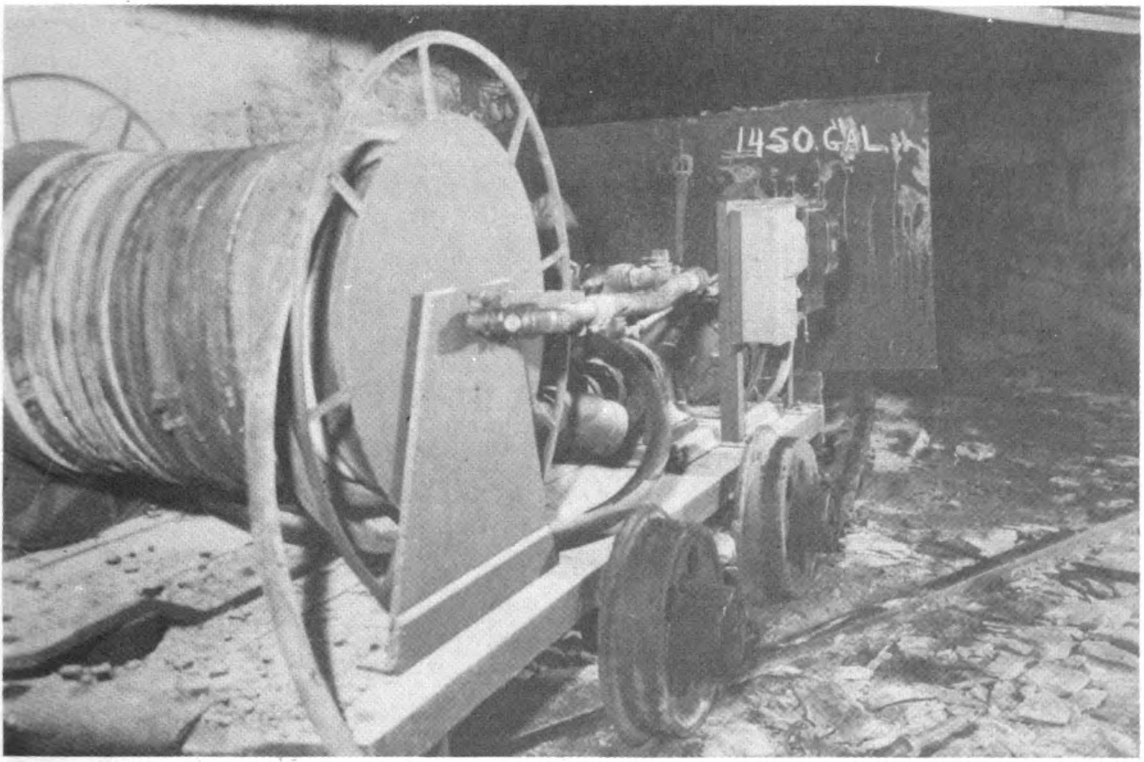

Figure 29. - End view of the 1,450-gallon-capacity fire car kept in the mine.

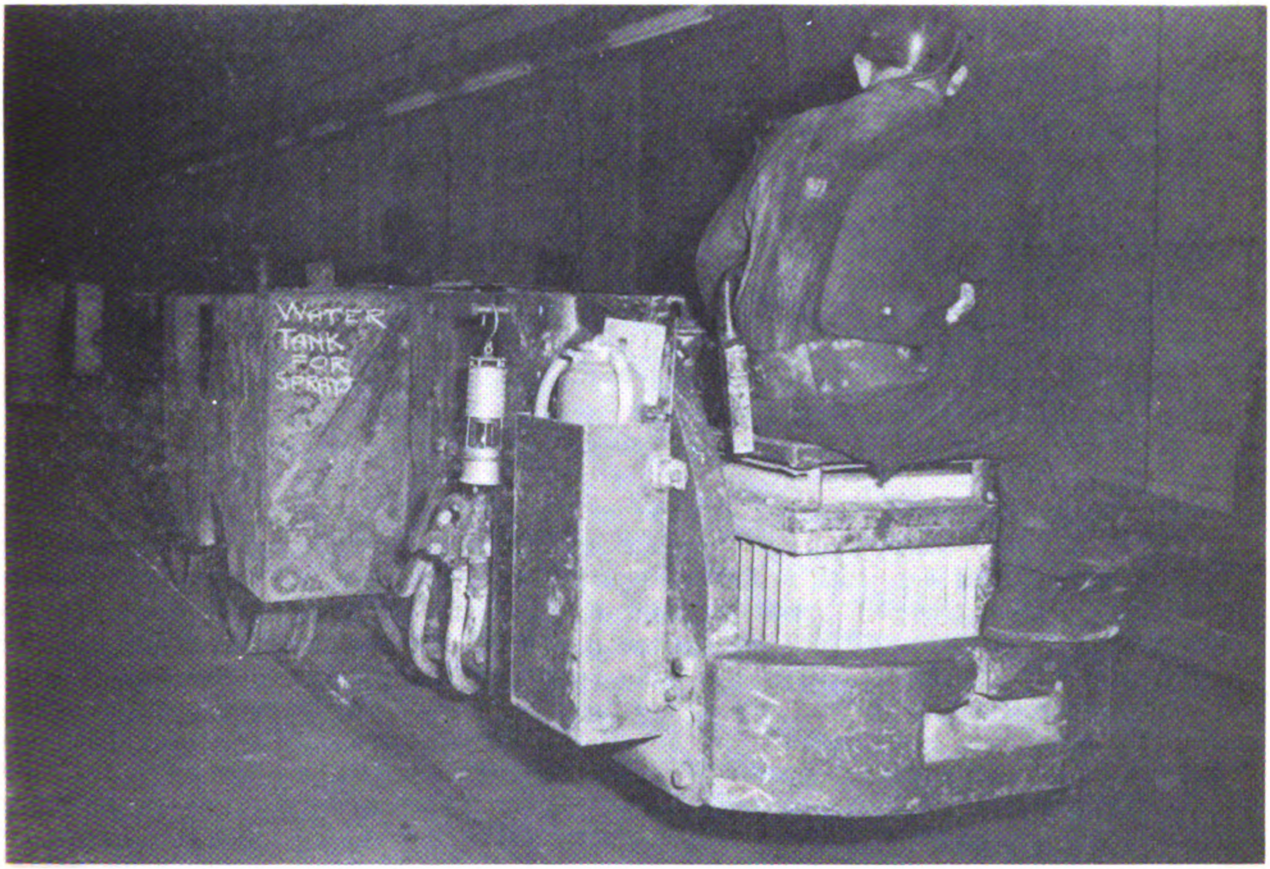

Figure 30. - Mining machine with 20-pound CO_2-type fire extinguisher and holder.

Numerous fire extinguishers ranging from 1-1/2-quart, hand-operated, liquid type to 30-pound CO_2 (duGas) type are provided in the tipple and cleaning plant; also, 100 feet of 1-inch hose connected to a water line and one 50-gallon barrel of water and buckets are maintained on each floor of the tipple and cleaning plant. Fire extinguishers of various types also are maintained in other buildings, such as the supply house, hoist rooms, lamp house, and shops.

Underground

The main pumping station for the mine is near the main shaft bottom. The sump at this station has a capacity of about 72,000 gallons of water. Water is pumped from several sections of the mine to this sump. Therefore, more than 72,000 gallons of water would be available at this point. This station, as stated elsewhere, supplies water to the wooden tank when needed. As stated above, a 6-inch pipe line extends from the wooden tank into the mine through the man-supply shaft. This line is to be connected to the fire-fighting system of the mine. A total of 16,200 feet of 4-inch pipe line had been laid along the main and panel-main haulageways. Fireplugs (outlets) had been installed at 500-foot intervals along 5,400 feet of the lines. The 4-inch line, with fireplugs at 500-foot intervals, will be extended to the inby end of the main and each panel-main section within the near future. Much of the equipment, such as valves, outlets, or fireplug connections, was on hand and being installed at the time the survey was made.

A 1,450-gallon fire truck, kept in readiness to be shuttled to any part of the mine, is maintained near the main shaft bottom. This machine is divided into two units and connected with a coupling link and hose. The 1,750 r.p.m. centrifugal pump is driven by a 5-horsepower, 250-volt, direct-current motor. The pump develops 100 pounds pressure in the 500 feet of 1-inch hose that is carried on a reel and equipped with a 3/8-inch nozzle. The pump, motor, control switches, hose, and reel are installed on one truck (see fig. 28), and the 1,450-gallon tank is installed on another (see fig. 29). The fire truck is also equipped with 500 feet of two-conductor cable and has connections for the purpose of obtaining water from sumps or ditches and the fire-line outlets. When operating under full force, the truck can throw a stream of water a distance of 75 to 100 feet horizontally.

Rock-dust stations containing 30 sacks of rock dust are maintained at 1,000-foot intervals along the main haulage roads. Twelve sacks of rock dust, mounted on a platform, are maintained at the entrance to each producing butt entry. In addition, mine cars containing materials for fire fighting are maintained at three places in the mine. The equipment in the cars is as follows: 2 rolls of brattice cloth, 15 sacks of rock dust, 1 keg of nails, lumber, and two 2-1/2-gallon soda-acid fire extinguishers. Also, three fire-fighting equipment supply rooms are maintained underground. In these rooms are kept three rolls of brattice cloth, nails, lumber, 2-1/2-gallon buckets, tools, and pipe fittings.

Each locomotive is equipped with a 15-pound CO_2 (duGas) fire extinguisher, and most mining machines (see fig. 30) are equipped with 20-pound

CO_2 extinguishers; the management has plans for equipping all the mining machines with such extinguishers. Each loading machine is provided with a sack of rock dust. Three 2-1/2-gallon foam extinguishers and 30 sacks of rock dust are maintained with each unit or on each producing section of the mine. A high-pressure rock-dusting machine also is used and maintained in the mine.

All permanent pump rooms, rectifier rooms, and underground shops are fireproof construction. The rectifier rooms also are equipped with automatic fire-emergency doors. One 1-1/2-quart liquid-type and one 15-pound CO_2 fire extinguisher and a bucket of sand are standard equipment for each underground rectifier room. Six sacks of rock dust and a 2-1/2-gallon soda-acid fire extinguisher are standard equipment for each pump room, shop, and motor barn. This equipment is placed outside the entrance to these places.

Although the program and facilities are not fully complete at this mine owing to lack of pipe and labor, as stated elsewhere in this circular, it will be observed that much thought has been given to the matter of controlling fires, and considerable progress has been made to date in equipping the mine with materials, facilities, and equipment for fighting fires that may occur. Moreover, it is expected that the fire lines, the remaining outlets or fireplugs, and other necessary equipment will be provided and ready for use within the very near future.

Montour No. 10 Mine
Pittsburgh Coal Co.
Library, Allegheny County, Pa.

The operating officials at the mine are:

J. T. Clark	Division superintendent	Library, Pa.
H. D. Laing	Superintendent	Library, Pa.
C. W. Parisi	Mine foreman	Library, Pa.
W. V. Barker	Master mechanic	Library, Pa.
Joseph Patellos	Safety inspector	Library, Pa.

The Montour No. 10 mine, at Library, Allegheny County, Pa., is developed in the Pittsburgh coal bed, which in this mine averages 63 inches in thickness. The mine is opened by two shafts and two drifts and is connected to the Montour No. 4 mine of the same company. A total of 540 men is employed, of which 459 work underground on two shifts 5 days a week. The average daily production is about 3,600 tons of coal, all of which is loaded by mobile loading machines and conveyors. At the present rate of production, the mine has an estimated life of 14 years.

The Pennsylvania Department of Mines classes the mine gassy.

Room-and-pillar mining is followed. The coal is cut by track-mounted and shortwall permissible-type mining machines. In fact, all electrical equipment used in the face areas is the permissible type.

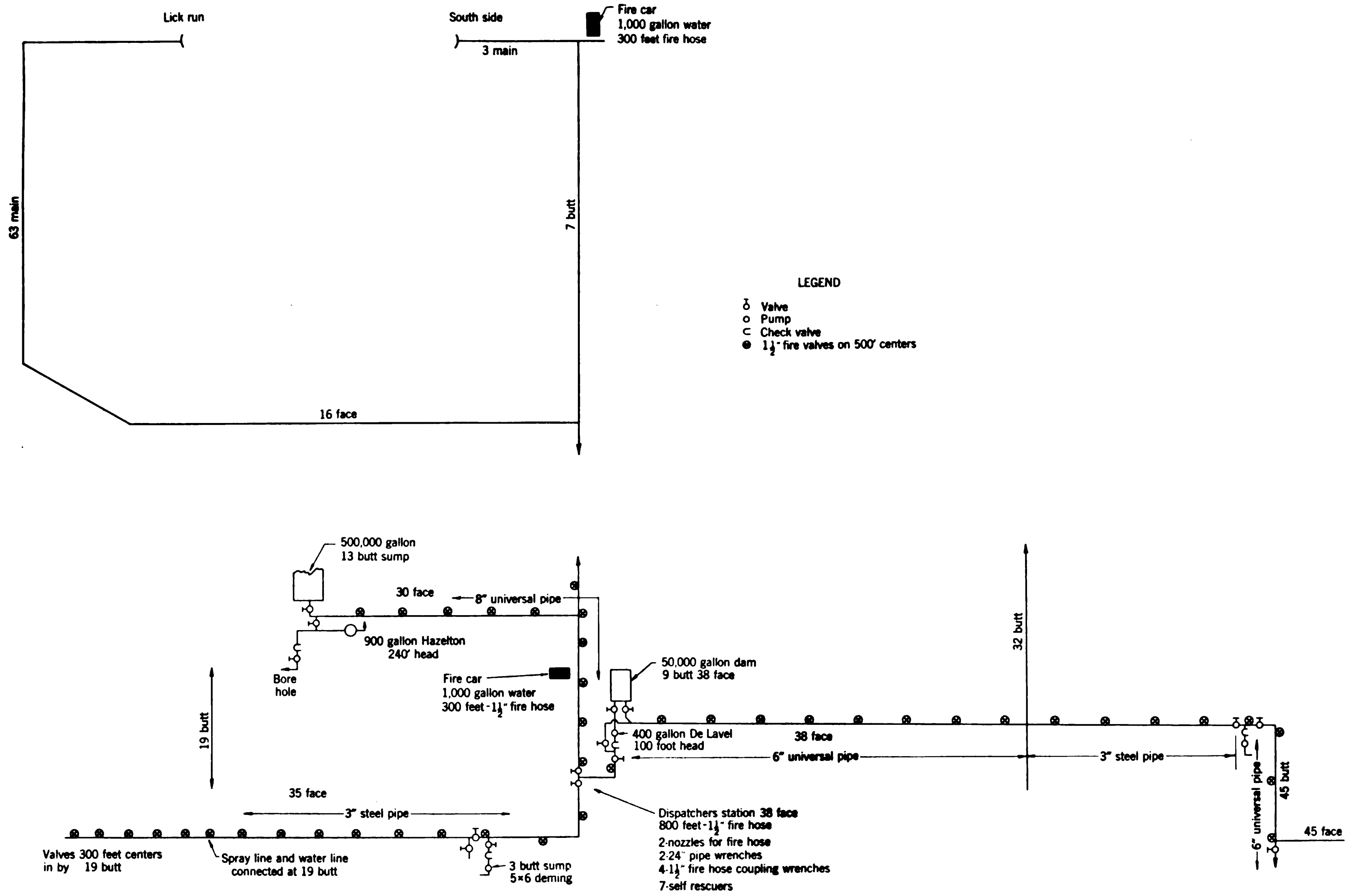

Figure 31. - Diagram of water system. Pittsburgh Coal Co., Montour No. 10 mine.

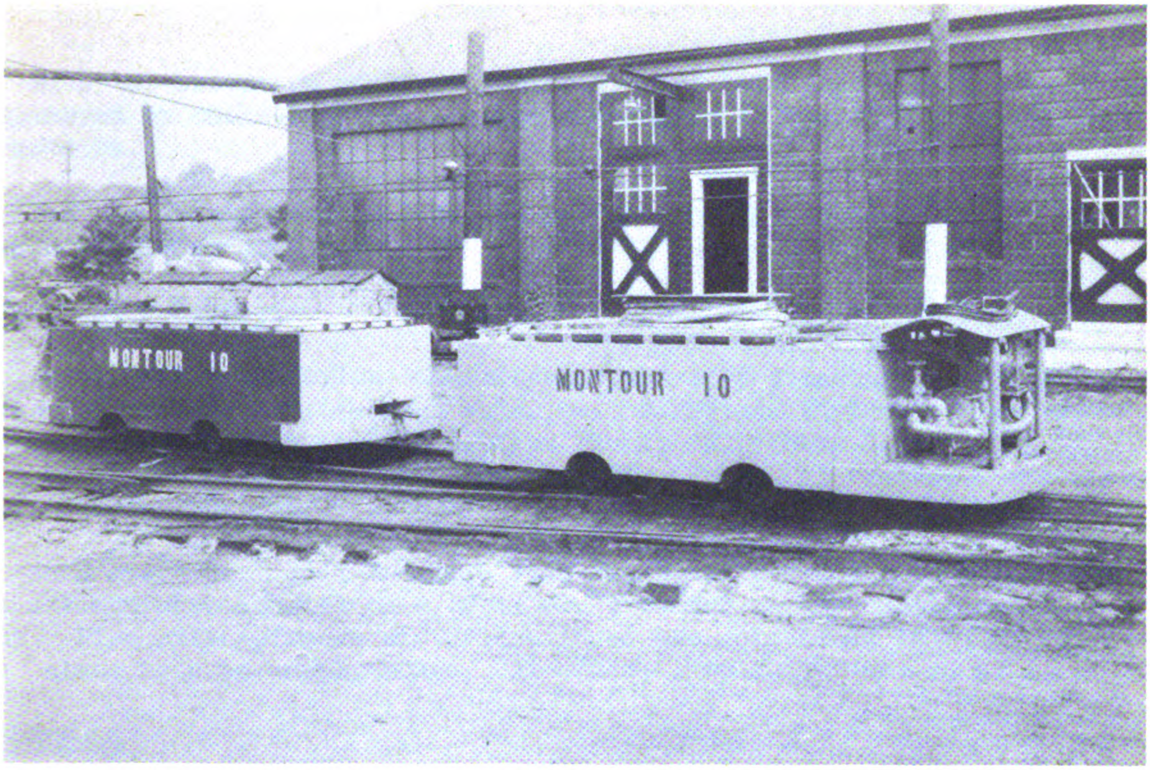

Figure 32. - A view of both fire cars. Note fire hose (300 feet of 1-1/2-inch size) on reel.

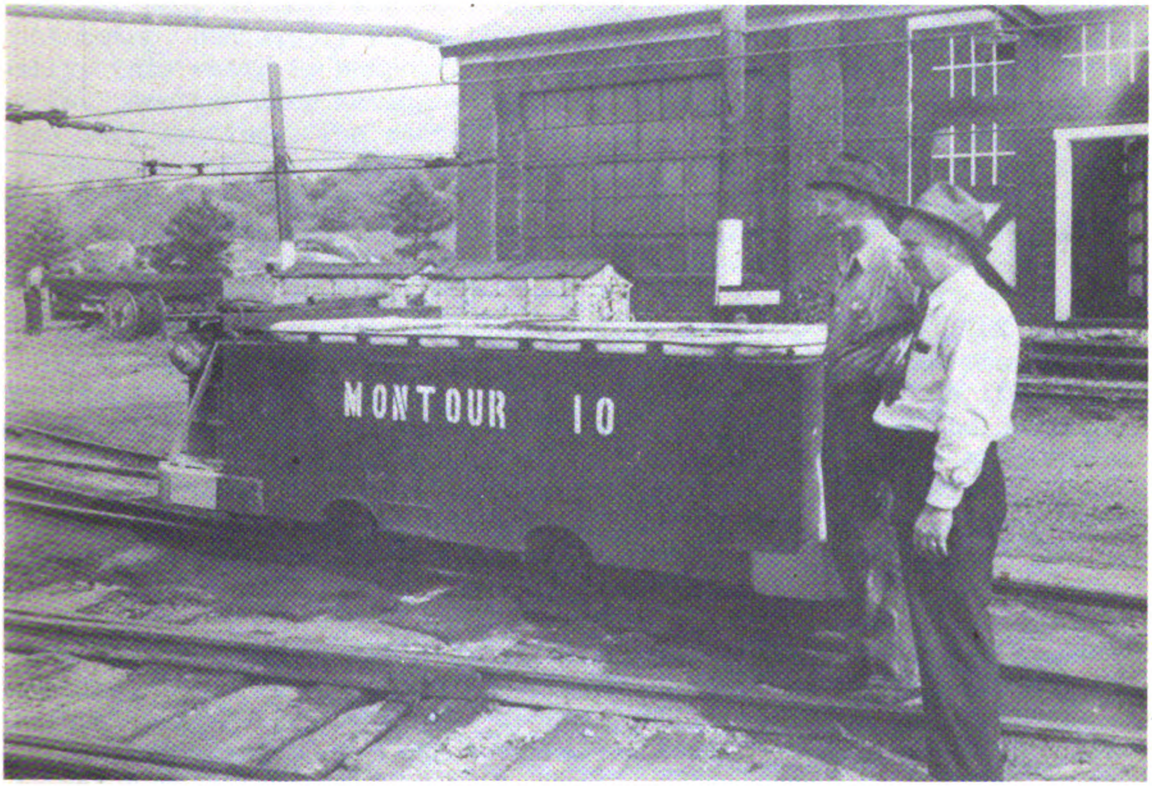

Figure 33. - Side view of fire car with fire hose coiled on top of it.

With the exception of three sections where belt conveyors are used, coal is gathered by cable-reel locomotives and hauled to the tipple by trolley locomotives.

Men are transported between the surface and the sections of the mine in covered steel man-trip cars.

Surface Water Supply

Water for dust allaying, coal cleaning, and fire fighting is supplied on the surface by the South Pittsburgh Water Co. Fireplugs (hydrants) are provided at strategic places around the surface plant. Fire hose long enough to reach any part of the surface plant is maintained. The plant buildings are generally fireproof construction.

Hand-operated liquid and foam fire extinguishers and a chemical tank fire extinguisher mounted on a truck are provided in the tipple and cleaning plant. Fire extinguishers of various types are maintained in other buildings also, such as supply house, oil house, lamp house, and shops.

Underground

Water stored in sumps at two places constitutes a supply for controlling fires underground. From a study of the diagram in figure 31 it will be observed that one sump in 30 face right holds 500,000 gallons of water. A centrifugal pump at this station, driven by a 50-horsepower, 550-volt, direct-current motor, can supply 900 gallons of water a minute at 110 pounds pressure. Normally, this water is pumped to the surface through a 10-inch pipe in a borehole. Another sump having a capacity of 50,000 gallons of water is in 38 face left section. The centrifugal pump at this station is driven by a 20-horsepower, 550-volt, direct-current motor and can supply 400 gallons of water a minute. Water is pumped from several sections, including the 38 face pumping station, to the 30 face right station; therefore, more water than the sump capacity would be available if needed.

Connections, by-passes, and valves have been installed at the pumping stations to supply water under sufficient pressure (100 to 150 pounds per square inch) for fire-fighting purposes from either the 30 face right or 38 face left station. A total of 21 fireplugs (outlets) at 300- to 500-foot intervals had been installed along the water lines at the time this study was made. A total of 19,900 feet of water lines (5,000 feet of 8-inch, 5,900 feet of 6-inch, and 9,000 feet of 3-inch), which extends from the pumping stations to the working sections along the main and panel-main haulageways, is provided.

Two fire cars that have a capacity of 1,000 gallons each are maintained in the mine. (See figs. 32 and 33.) Each of these cars is equipped with a centrifugal pump driven by a 5-horsepower, 550-volt motor, 300 feet of 1-1/2-inch hose, two nozzles 3/8 and 1/2 inch in size, 350 feet of twin-conductor cable, and connections for the purpose of pumping from sumps, ditches, or outlets along the water lines. The pumps on the cars produce a pressure estimated to be between 80 and 100 pounds per square inch at the end of the hose. (See fig. 34.) One of these cars is between the surface (see fig. 31) and the 30 face left, to be used in the area that water lines do not reach.

Fire-fighting equipment is maintained at the dispatcher's station along the main haulageway at the junction with 38 face left, which is one of the largest producing sections of the mine. The following equipment is maintained at this station: 800 feet of 1-1/2-inch fire hose, two nozzles for fire hose, two 24-inch pipe wrenches, four 1-1/2-inch fire-hose-coupling wrenches, and seven self-rescuers. In addition, seven of the locomotives are equipped with 30-pound CO_2 fire extinguishers, and the company has plans for equipping all locomotives with this type extinguisher. Two bags of rock dust are maintained at all doors along haulage roads. A high-pressure rock-dusting machine and two cars of rock dust are maintained at a strategic location for fire-fighting purposes. Buckets filled with sand are maintained at all pumps and air-compressor stations. A 30-pound CO_2-type fire extinguisher is maintained on each producing section of the mine.

Although the program is not complete at this mine, it can be observed that the management is taking advantage of available underground water and is attempting to provide adequate facilities and equipment to extinguish fires that may occur.

REQUIREMENTS OF MINING LAWS AND FEDERAL SAFETY CODE FOR FIRE-FIGHTING FACILITIES

A study of the mining laws of the coal-producing States discloses that little or no fire-fighting facilities are required. The Federal Mine Safety Code contains the following: "Article X, Section 1a.- Each mine shall be provided with suitable fire-fighting equipment adequate for the size of the mine, such as supplies of rock dust at doors and at other strategic places, water lines and hose, water or chemical trucks, and fire extinguishers," and "Article X, Section 1b.- Clean dry sand, rock dust, or fire extinguishers, suitable from a toxic and shock standpoint, shall be provided and placed at each electrical station (substations, transformer stations, permanent pump stations) so as to be out of the smoke in case of fire in the station."

Obviously, every large or fairly large mine should be provided with all the items mentioned, particularly water lines and hose, if they are to be considered as having adequate fire-fighting facilities and complying with the code.

CONCLUSIONS

Mine fires in bituminous-coal mines have resulted in much property damage and loss of production and have caused the loss of many lives. Many mine fires have reached serious proportions, often with costly and fatal results, because adequate facilities for fighting fires had not been provided or the personnel had not been properly trained to use the available facilities promptly and effectively.

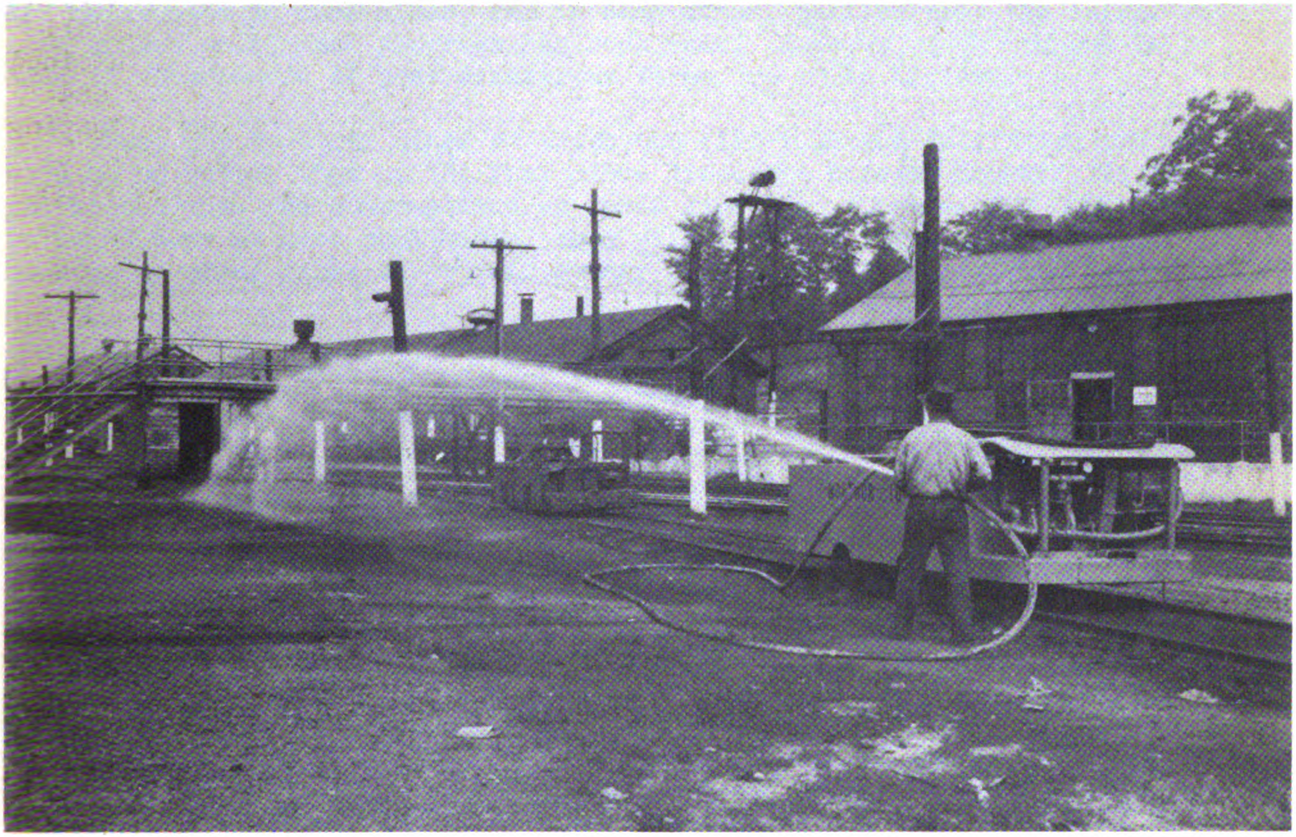

Figure 34. - One of the fire cars in action. Distance from nozzle to end of water stream is 90 feet.

In view of the deplorable record, both with respect to the frequency of occurrence and the disastrous and often fatal results of mine fires, all persons connected with the mining industry should be deeply concerned with the prevention of fires and providing effective means for combating them. No large or fairly large mine can be considered as having adequate fire-fighting facilities unless its facilities include an ample water supply, water lines with outlets at frequent intervals, and hose and nozzles, so that water will be readily available throughout the mine for fire fighting.

Improvements in fire prevention and in providing fire-fighting facilities are noticeable in many mines, and in some mines, particularly the larger and more modern ones, much progress has been made. However, much remains to be done if recurrences of past disastrous fires are to be avoided.

There may be other mines at which the fire-fighting facilities are as good as or better than at the four mines discussed herein; however, as the provisions made and contemplated at these mines are considerably more than is being done at most coal mines, they will serve to indicate what might be done at other mines to provide better fire-fighting facilities.